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Engineering and Mining Journal

Volume 102, No. 5
Issued Every Saturday
Hill Publishing Company

NEW YORK, JULY 29, 1916

Price, 15 Cents
Contents, First Page
Advertising Index, Last Page

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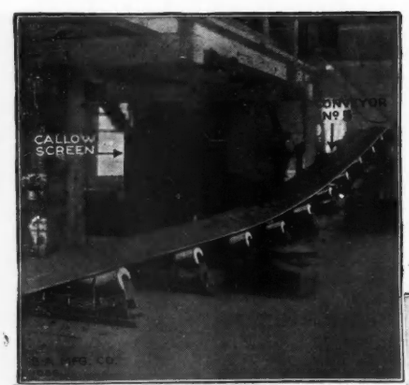

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Engineering and Mining Journal

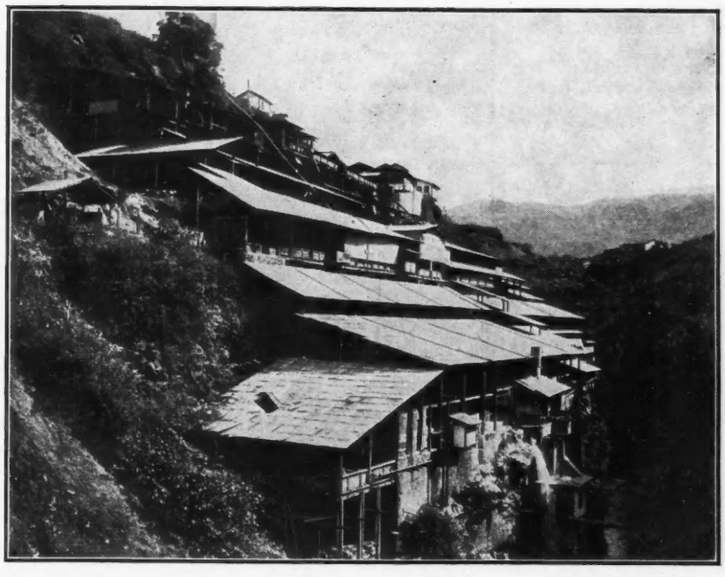
VOLUME 102 JULY 29, 1916 NUMBER 5

The Gold Mines of Brazil

By Benjamin Le Roy Miller* and Joseph T. Singewald, Jr.†

SYNOPSIS—Brazil has two remarkable gold mines, but generally speaking, gold mining has received little development. Placers received first attention when Portuguese opened the country, but are of little importance today. Morro Velho mine of St. John del Rey Mining Co. is the world's deepest gold mine and the oldest now in operation on Western Hemisphere.

The great country of Brazil, where gold mining has been carried on continuously for over 200 years and where gold has been found in every one of the states comprising the republic is not particularly known for its mineral wealth. Notwithstanding its inferiority in comparison with some of the other countries of South America, where more mines have been worked, Brazil is of peculiar interest to the mining profession because of some most unusual gold mines which it possesses. It can lay claim to the oldest gold mine now in operation in the Western Hemisphere, the deepest mine in the world and two of the best-managed gold mines to be found anywhere. The gold deposits of Brazil belong to the two major classes—alluvial, or placer, deposits and lodes. As is true in practically every country of the world where gold has been obtained, the placers of Brazil received first attention and evidently were worked in a primitive manner by the aborigines who were found in possession of the country by the earliest Portuguese explorers. The Portuguese early began their search for gold, but not until the last years of the Seventeenth Century did they discover the rich alluvial deposits in what is now the state of Minas Geraes, the chief mining state of Brazil.



PASSAGEM MILL OF OURO PRETO GOLD MINES OF BRAZIL, LTD.

Placer mining was extensively carried on for many years, but was gradually superseded by lode mining. Small placer operations still continue; several companies during the last few years have investigated the placers of the Jequitinhonha River, and two dredges have been operated there but without success. While placer mining in a small way will undoubtedly be carried on for many years to come, conditions do not appear very favorable for large operations.

Placer mining was followed by the working of the *jacutinga* ores, which consist of layers of loose flakes of specular hematite and quartz containing thin veins of gold. By hydraulic methods much work of this kind was done. Along many streams, especially near Cattas Altas, deposits of the specular hematite waste 15 to 20 ft. in thickness cover many acres. Mines of this character were of such low grade that they could be worked with profit only where water could be brought economically to the site of the working. In places these old abandoned ditches winding among the hills are many miles in length. Ordinary quartz-vein lodes were later worked in many places, but especially near Diamantina and in the vicinity of Ouro Preto. In most cases the mines were continued until considerable water was encountered, when they were abandoned. Several mining men are confident that some of these old mines might be reopened and worked with profit, yet the capital necessary for such work is not forthcoming although on a small scale some of these quartz lodes are now worked intermittently.

At present, however, gold mining in Brazil is practically confined to two operations—the Morro Velho and the Passagem mines, both in the state of Minas Geraes. These mines have produced an enormous amount of gold and seem to have many years of prosperity ahead of them. In a country as large as Brazil, with gold found in hundreds of places, it seems strange that only two

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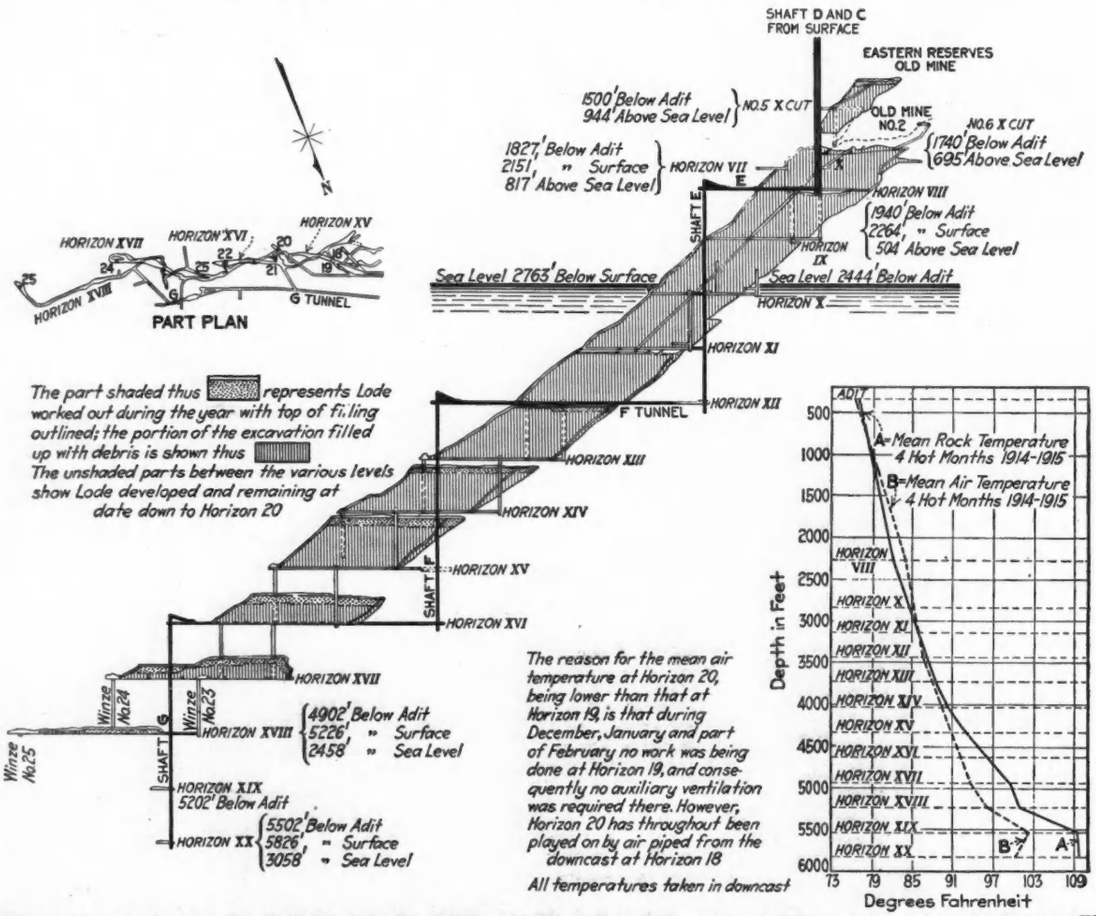
important deposits should be known and it is to be expected that systematic search may result in the discovery of other deposits equally rich. At present, however, one might well profit by the experiences of numerous saddened individuals and not place too much reliance in some of the glowing accounts of the wonderful opportunities for gold mining in Brazil.

Morro Velho—the World's Deepest Gold Mine

The Morro Velho mine of the St. John del Rey Mining Co., at Villa Nova de Lima in the State of Minas Geraes, is the most interesting mine in all South America and in some respects one of the most remarkable in the world. The company is the oldest registered English mining company, having been organized in 1830 for working a gold mine in Brazil. In 1834 the company acquired its present property, the Morro Velho mine, which, with few interruptions, has been operated ever since.


SHAFT D AND C FROM SURFACE
EASTERN RESERVES OLD MINE
1500' Below Adit 944' Above Sea Level } NO.5 X CUT
OLD MINE NO.2
NO.6 X CUT
1740' Below Adit 695' Above Sea Level
1827' Below Adit 2151' " Surface 817' Above Sea Level } HORIZON VII
HORIZON VIII
1940' Below Adit 2264' " Surface 504' Above Sea Level
HORIZON IX
SHAFT E
Sea Level 2763' Below Surface
Sea Level 2444' Below Adit
HORIZON X
HORIZON XI
F TUNNEL
HORIZON XII
HORIZON XIII
HORIZON XIV
HORIZON XV
SHAFT F
HORIZON XVI
HORIZON XVII
Winze No.24
Winze No.23
Winze No.25
SHAFT G
HORIZON XVIII
4902' Below Adit 5226' " Surface 2458' " Sea Level
HORIZON XIX 5202' Below Adit
HORIZON XX
5502' Below Adit 5826' " Surface 3058' " Sea Level
PART PLAN
HORIZON XVII
HORIZON XVI
HORIZON XV
HORIZON XVIII
G TUNNEL
The part shaded thus represents Lode worked out during the year with top of filling outlined; the portion of the excavation filled up with debris is shown thus
The unshaded parts between the various levels show Lode developed and remaining at date down to Horizon 20
The reason for the mean air temperature at Horizon 20, being lower than that at Horizon 19, is that during December, January and part of February no work was being done at Horizon 19, and consequently no auxiliary ventilation was required there. However, Horizon 20 has throughout been played on by air piped from the downcast at Horizon 18
All temperatures taken in downcast
A=Mean Rock Temperature 4 Hot Months 1914-1915
B=Mean Air Temperature 4 Hot Months 1914-1915
Depth in Feet
Degrees Fahrenheit
ADIT
HORIZON VIII
HORIZON X
HORIZON XI
HORIZON XII
HORIZON XIII
HORIZON XIV
HORIZON XV
HORIZON XVI
HORIZON XVII
HORIZON XVIII
HORIZON XIX
HORIZON XX
B
A

LONGITUDINAL SECTION OF MORRO VELHO MINE OF ST. JOHN DEL REY MINING CO. ALSO TEMPERATURE CHART, AT THE RIGHT

At present the mine claims the world's record for depth, the deepest workings being 5,826 ft. below the surface, and the end is not yet, as plans are now being prepared to sink another shaft 1,200 ft. below the present lowest level. George Chalmers, the able and optimistic mine superintendent, who has been in charge for 32 years and is mainly responsible for the great success of the company, states in his last annual report that "it appears that at any rate (of temperature increase) supposing the lode continues the same in size and value to horizon 26 (a vertical depth of 7,626 ft.), it could be worked profitably to that point and even to a much greater depth." The persistence of the orebody and the absence of any material change in the tenor of the ores with depth are of especial interest, as both are in disagreement with ideas commonly held by mining men.

Leaving Rio de Janeiro on the Central R.R. at 7 p.m. we reached Raposos station the next morning. There we transferred to the narrow-gage trolley line, 8 km. in length, built by the mining company, and in half an hour reached the mine. Although the mine staff consists almost entirely of Englishmen, some Brazilian customs have been adopted and after meeting our hosts we were accordingly asked to partake of black Brazilian coffee before going to visit about the property.

No one can visit the Morro Velho without being impressed with the order and neat appearance of the plant. Situated in a hilly region at an elevation of 2,774 ft. above sea level, with surrounding hills considerably higher and the steep slopes covered with tropical vegetation, the whole effect is most pleasing. One is reminded of Grass Valley, Calif., the most beautiful mining camp in the United States, although there are many important differences. While the shrubs and small trees covering the slopes make a pleasing setting to the camp, they are to be avoided as much as possible, as they harbor the tiny pestiferous *garrapatos* (a species of ticks), which are so poisonous to most persons that a high fever may result from the bites of a number of them. Other insects that burrow beneath the toenails of the workmen,

whence they are extracted with difficulty, and still others that lay their eggs beneath the skin, where the grub feeds upon the tissues, make one think at times that tropical scenery and physical comforts are incompatible and it would be well to sacrifice the former for the latter. The insect pests do not confine their attention to the workmen, but also ravage their houses. Only recently the Casa Grande and company offices had to be repaired at the cost of about $5,000 because of the white ants having eaten the heart of the supporting timbers until only shells remained, although to all outside appearances the supports were perfectly sound.

Vein Dips at 45° and Gold Occurs Chiefly with Arsenopyrite

The country rocks of the Morro Velho region consist of calcareous schists which have been greatly sheared in places with the development of considerable mica and chlorite. The orebody, which is lenticular in a vertical direction, dips into the earth at an angle of about 45°. The accompanying longitudinal section shows a side view of the workable parts of the vein. The vein, however, continues farther but becomes too narrow to be worked profitably. The average width of the orebody is 10 to 12 ft., with a maximum width of 33 ft. In certain places it has been found profitable to follow the vein until the width decreases to 1 ft. The stope length throughout most of the mine is about 600 ft., but in the recently opened levels is almost 1,000 ft. While the orebody is, in the main, approximately vertical, there are occasional irregularities, and at certain places a vertical cross-section would appear much like the letter S.

There is no gouge present, and the schistosity of the rocks being parallel to the orebody although away from the vein, the strike of the country rocks is quite different in direction, indicating that the region suffered greatly by compression after the deposition of the ore.

The orebody consists mainly of quartz, siderite, dolomite, calcite, forming the gangue materials and containing the sulphides—pyrrhotite, pyrite, arsenopyrite and a small amount of chalcopyrite. The arsenopyrite carries most of the gold; free gold is rarely seen. Bands of quartz with practically no sulphides are sometimes found.

Mine Now Worked Through Series of Shafts and Adits

In the early operations of the mine the opencut mining method was employed and the walls were supported by heavy timbers. With increasing depth it became more difficult to support the walls, and after a serious fall of rock which closed the mine for some time, two parallel shafts were sunk in the country rock near the vein. From the bottom of these shafts a cross tunnel was run to intersect the vein some distance below the old workings. An adit strikes these shafts 324 ft. from the surface. As shown in the longitudinal section, in order to reach the bottom of the mine, one goes through the adit to Shafts *C* and *D* and then descends in a vertical shaft 1,940 ft. to Horizon 8. Passing through Tunnel *E* about 600 ft. to the top of Shaft *E*, which is 1,160 ft. deep, one descends to Horizon 12. In succession, through Tunnel *F*, Shaft *F*, Tunnel *G* and Shaft *G*, Horizon 20, which is 5,826 ft. below the surface, is finally reached. Every 300 ft. drifts are run to the orebody. When we visited the mine, the drifts at Horizons 19 and 20 had not yet reached the orebody. It is expected that ore will be taken from Horizon 19 by June, 1916, and from Horizon 20 in April, 1917.

The ore as mined is brought to the surface at once, as it has been found that the contact of the surface air fanned into the mine for ventilation quickly oxidizes the broken ore with the formation of sulphuric acid and consequently more cyanide is required in the treatment of the ore. The pressure in the deeper horizons that are now being worked is so great that the stopes must be filled at once. Formerly the mill tailings were used for filling, but as considerable heat was generated in the oxidation of the pyrite which continued after the refuse had been returned to the mine, it became necessary to use other material. Rock quarried near the mouth of the mine is now used for this purpose.

Hydraulic winding engines are used in Shafts *C* and *D*, but below are engines driven by compressed air. About 30 mules are used in the mine, but as the mortality among these animals is in some years as great as 50% and besides in the hot mine the conditions are less sanitary because of them, it is planned to substitute accumulator electric locomotives made by the General Electric Co.

The men employed in the mine are native Brazilians, mixtures of the aboriginal Indians, the negroes brought from Africa as slaves, and the Portuguese. As there are practically no race distinctions in Brazil except in some of the larger cities, the three races have intermarried to a greater extent than in any other country in the Western Hemisphere. In general the laborers are both lazy and inefficient, and in addition the supply was decidedly deficient until the European War caused the cessation of railroad building throughout the country. To remedy this condition the company tried the experiment of importing some Japanese workmen a few years ago, but this proved to be a failure, as the men soon deserted in spite of the fact that the company employed all possible means to make them comfortable. On an average there are about 2,500 natives employed by the company, and they are paid about $1 a day for ordinary work. The men working on the surface receive less; some women employed at the picking tables receive about 25c. a day.

In the upper levels there was considerable water, but in the lower workings it is necessary to sprinkle the passageways to keep down the dust. The dust from the drills has had some effect in causing lung trouble among the workmen, but by no means to the same extent that it has on the Rand.

Ventilation Now One of the Chief Problems

One of the most interesting problems that the company has had to solve is that of ventilation. With increasing depth the mine has continually grown hotter, although fortunately at a rate lower than that prevailing in some parts of the world. The average rate of increase is about 1° F. for every 125 ft. of increase in depth. Nevertheless, at this comparatively low rate, in the lowest workings the temperature of the rocks is 110° F. and the air pumped from the surface is slightly more than 100° F. The workmen are covered with perspiration all the time they are in the mine, and it has become apparent that their efficiency is reduced. Up to the present the air driven into the mine by Sirocco fans has been the ordinary air of the surface. During the

hot months of December, January, February and March this air has a temperature above 70° F. at the surface. As it is forced into the mine, it increases in temperature, owing to compression, at the approximate rate of 1° F. for every 180 ft. increase in depth and consequently is very hot when it reaches the bottom of the mine, and its cooling effect upon the workmen is mainly due to the evaporation of the perspiration. At times, however, the humidity of the air before being fanned into the mine is high and the evaporation of the water used to sprinkle the mine further increases the humidity until its cooling effect is greatly reduced. As the air is forced to the bottom of the mine directly and then rises through the upper levels, the hottest stopes are those a short distance above the lowest workings.

For some time the company has been working on a system for cooling and drying the air before introducing it into the mine, and no doubt this will soon be in operation.

In his latest report Mr. Chalmers states: "There are many other causes for increase in temperature in the mine—those due to the friction of the air, heat from machinery, lights, decomposition of mineral, heat from the bodies of men and animals, etc.—but the heating effect from the rock and that due to the compressing of the atmosphere as it descends into depth are, in the case of this mine, the most serious, and it is evident that unless the air as it enters the mine is made considerably cooler than the average surface temperature, it would in descending into depth arrive at a point below the present bottom, where its temperature would not allow men to work."

Ore Cyanided After Mechanical Concentration

The ore treatment is divided into two parts—the mechanical, where concentrating tables are used, and the chemical, or cyanide, treatment. Only the mechanical concentration will be described.

The ore is brought out through an adit 324 ft. below the mouth of the surface shaft and taken up an incline to the mill. It first passes through a Blake crusher and then over a trommel with 3-in. openings. The oversize goes to a revolving circular picking table where women pick out the pieces of country rock. The ore left on the table passes through a smaller Blake crusher and joins the undersize of the trommel. It is then fed automatically to the stamps. There are one hundred and twenty 750-lb. and ten 1,200-lb. stamps. The feed of the stamps is 8 or 9 of clear water to 1 of rock, and the drop of the stamps is 9 in. The stamp pulp passes through 60-mesh phosphor-bronze screens and thence to three-deck canvas tables.

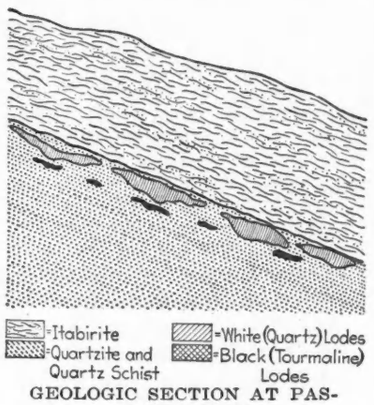
There are 46 tables in this first line, the tailings from these going to the tube mills while the concentrates are further treated on 36 tables on the second line, where again the tailings go to tube mills and the concentrates to 10 more tables in the same line. The concentrates from the 10 tables pass over four other tables in the third line. From the canvas tables about 70% of the gold is recovered. The tables are cleaned by being tipped to a vertical position and automatically washed by sprayers that travel across the rows of tables from one end to the other every half-hour.

Before going to the tube mills, the tailings from the tables pass through conical separators, the overflow going directly to the cyanide plant and the settlings to the mills for further grinding. In the tube mills the company has recently substituted for the foreign flint pebbles, formerly used, some extremely hard low-grade gold ore from its Cuiabá mine on the Santa Barbara branch of the Central R.R. The ore is partly ground in a rough tube mill at Cuiabá, where there is available power, and in that way a freight saving is effected.

Hydro-Electric Power Essential

The power used by the company is hydro-electric, obtained from the Rio de Peixe, which supplies about 3,500 hp. During the dry months some auxiliary steam and gas power is required. During the last few years the rainfall has been inadequate, the total for the year ended February, 1915, being only 42.54 in., while the average since 1875 was 65.34 in. This reduction, coupled with the necessity of additional power on account of the increased depth of the mine, will shortly compel the company to build another hydro-electric plant along the same river. As all the coal consumed must be brought from England or the United States at great expense, the company must continue to rely almost exclusively on water power.

During the year ended Feb. 28, 1915, there was a total of 199,234 tons of ore mined; 4.11% was rejected and 191,500 tons crushed. The gold and silver from this was sold in London for $2,215,805, an average of $11.57 per ton of material milled. The profits amounted to $700,287. At that time the ore reserves totaled 699,704 tons, a supply sufficient for 3½ years' work. When the tunnels being driven at Horizons 19 and 20 reach the orebody, an approximately equal amount of reserves will be added, so that the mine bids fair to continue its long and prosperous career for years to come.



GEOLOGIC SECTION AT PASSAGEM MINE

The Passagem mine of the Ouro Preto Gold Mines of Brazil, Ltd., is about 8 mi. east of Ouro Preto and a few miles from Mt. Itacolumi, from which the name itacolumite (flexible sandstone) has been derived. Incidentally, it is interesting to know that North Carolina produces finer specimens of itacolumite than can be obtained at the type locality.

The town of Passagem has a population of about 3,000, all dependent upon the mine. About the mining property the superintendent, Arthur J. Bensusan, has directed and encouraged the planting of flowers of all kinds, and few places can boast of such magnificent roses, fuchsias and poinsettias.

The Passagem mine is the second gold mine in Brazil in importance and, like the Morro Velho, is very old, yet shows little indication of approaching exhaustion. Baron von Eschwege, a Prussian mining engineer who was employed by the Portuguese government to investigate the gold mines of Brazil, opened the Passagem mine

in 1817 and, it is said, installed there the first stamps used in that country.

The country rocks of the region consist of quartz schists or quartzites overlain by itabirite, a rock consisting of alternating laminæ of specular hematite and fine quartz sand. In places the itabirite consists of loose flakes of specular hematite (*jacutinga*), while the same formation a few miles distant contains extensive deposits of high-grade iron ore that have recently attracted the attention of the world.

Ouro Preto Works Two Lodes, Separated Usually by Several Feet of Barren Quartzite

The ore horizon is found at the contact of the quartzite and itabirite and dips to the southeast at varying angles, but in most places from 15° to 20°. The lodes are of two kinds: Close to the contact are the white lodes, consisting mainly of a white-quartz gangue, while below

ROCK WORK AT PASSAGEM MINE

these are the black lodes, containing principally black tourmaline. The white lodes are practically continuous and lie in the quartzite close to the itabirite, separated from it by a thin layer of altered itabirite ranging in thickness up to 18 in. This band of altered rock is known as *guia* (guide rock). The lodes are irregular, varying in thickness up to 36 ft. and extending through two or three levels in certain parts of the mine. The gold is irregularly distributed throughout the quartz, occurring in dark streaks or patches associated with tourmaline, pyrrhotite and arsenopyrite. The gold is principally in the arsenopyrite as in the case of the Morro Velho mine.

The black lodes consist mainly of black tourmaline, pyrrhotite and arsenopyrite, with some quartz. These lodes are smaller, seldom more than 3 ft. in thickness, and are found beneath the white lodes. In places the two lodes are in contact, but in most instances several feet of barren quartzite separate them. The black lodes are much richer, but the expense involved in searching for them and their small size decrease their importance.

The ore as taken from the mine averages about $7 a ton. Occasionally ore running only $5 a ton is removed, but this is only done when it is obtained with little additional expense while driving levels and stopes.

At the 920-m. level a pocket of ore containing about $2.50 a ton was recently found in the overlying itabirite, which is of considerable interest, as previously no gold had been found in that rock by the present company. However, in the early days considerable mining was done in the itabirite in this vicinity, as shown by the extensive dumps.

Much cyanite is found in the quartzite a short distance below the black lodes, but no gold. When the cyanite is encountered, no further search is made for ore. However, near Ouro Preto, a few miles distant, numerous quartz veins have been worked in that rock.

The ores have been formed by ascending highly heated waters that replaced the quartzite, and in places one can see the lines of stratification passing from the quartzite into the orebodies, both the black and also the white lodes. The presence of some minerals commonly found in pegmatites indicates that the veins are, in part, at least, of a pegmatitic character and somewhat different from the ordinary quartz veins. There is no doubt of the continuity of the orebodies to depths below the levels now being worked.

At the 770-m. level a disturbed zone has been encountered that in direction corresponds with a prominent valley that cuts across the country. There are here numerous folds and a few small faults, so that it is difficult to keep the inclined shaft in the foot wall a short distance beneath the orebodies except by occasional changes in slope. The value of the ore in the disturbed area is lower on account of much rock being mixed with it.

Mine Opened Through Three Inclined Shafts

The mine is worked by means of three inclined shafts that start at the mill and diverge underground. Crosscuts from the shafts are driven, keeping near the contact of the quartzite and itabirite. When ore worth stoping is encountered, a 6-ft. slice is taken above the drift level and the old openings are filled as the work advances. Practically no timber is used in the mine; the *guia* forms a good roof in most places, but where it is broken through the itabirite scales off badly. The rock used for filling consists of the quartzite in part obtained in running drifts in search of the black lodes. The quartzite breaks readily into thin slabs well adapted for the construction of retaining walls and arches, such as shown in an accompanying illustration. In the upper levels there is some water, but this is carried out through a tunnel into the deep gorge that cuts through the property.

The gently inclined shafts, following the orebodies and approximately parallel with the slope of the hill, have been extended so far from the mill that a vertical shaft has recently been sunk which strikes the ore horizon at a depth of about 200 m.

The power for mine and mill is supplied from the Carmo River. During the dry season the supply is inadequate so that a new hydro-electric plant is in process of construction a short distance below the mill. A ditch and tunnel are being excavated along the side of the stream through which the water will be diverted and a 120-ft. fall obtained that will furnish an addition of 500 hp. to that already possessed.

The mill is picturesquely situated along one side of the gorge of the Carmo River, which Doctor Derby has likened to Watkins Glen. The lower part of the mill almost fills the gorge, and as it is extended, as it will be soon, it will entirely bridge the river.

No new features are involved in the mill. After passing across a picking table, where about 10% is rejected, the remaining ore is passed over a grizzly with 2-in. openings. The oversize passes through a Blake crusher and then, joining the undersize from the grizzly, is fed to the stamps. The pulp from the stamps passes over blankets 4 ft. long and 20 in. wide, where much of the coarser sulphides and gold is collected. At intervals the flow of pulp is shut off while boys replace the old blankets with clean ones. The further mechanical treatment consists of passing the material over vanners where fine sulphides and gold are collected. The final process of gold recovery is by cyanidation.

The production figures for 1914 are the latest available. During that year there was a total of 80,138 tons of ore treated in the mill from which 27,085 oz. of gold were recovered. This bullion sold for $556,800, an average of a little less than $7 per ton of ore milled. The reserves on Dec. 31, 1914, were 112,678 tons.

Decision on Extralateral Rights

By Arthur L. H. Street*

To the body of mining law the Montana Supreme Court lately added an instructive discussion of the history of extralateral mining rights, at the same time making clearer the rules which are to determine conflicting claims to orebodies in that state. The opinion appears in the case of Anaconda Copper Mining Co. vs. Pilot-Butte Mining Co., 156 Pacific Reporter, 409.

After declaring that the effect of Sec. 2322 of the United States Revised Statutes is such that discovery upon a vein of ore which cuts at least one of the parallel end lines of a claim and has its apex within the surface lines of the claim extended downward vertically gives to the locator exclusive possession of the surface and of all veins, lodes and ledges therein throughout their entire depth, although such veins, lodes or ledges so far depart from a perpendicular in their course downward as to extend outside the vertical side lines of such location, the court says:

> The common law would give to each of these claims all orebodies beneath its surface. The right which a locator has to follow his vein on its dip beneath the surface of another claim is purely of statutory origin. The statute is but the outgrowth of mining rules and regulations in force in California, Nevada and other Western territory before the Congress enacted the first statute in 1866; and these rules and regulations were largely the result of the application to existing conditions of the Spanish ordinances in force in Mexico, with possibly some ideas borrowed from the customs of the High Peak of Derbyshire and the laws of Prussia. . . . The doctrine of extralateral rights had its origin in the theory that it is the vein which is actually located and that the surface is a mere incident, necessary for the convenient development of the mine.

After applying the provisions of Sec. 2336 of the Revised Statutes, to the effect that where two or more veins unite, the oldest or prior location shall take the vein below the point of union, including all the space of the intersection, the court proceeds:

> By some of the courts and text-writers it is said that to entitle a claimant to extralateral rights there must be continuity of vein from the apex to the ore in dispute; by others that there must be identity of vein. It is of little moment here which of these statements is correct; but that there must be continuity of right in the locator who seeks to follow a vein from the apex within his claim to the ore beneath the surface of another claim is in effect the holding of this court, and its correctness in our judgment cannot be gainsaid.

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Brazilian Mineral Exports, 1915

Of all Brazil's ores, manganese is the only one that has found a place among the more important of the country's exports. The United States has always been Brazil's best customer for manganese ore, and the trade within the last few years, and especially since the establishment of the Steel Corporation's United States & Brazil Steamship Line, has increased considerably. The line seems not only to have solved the problem of securing return cargoes, which in past years had been the difficulty of all shipping ventures between the United States and this coast, but it has built up a substantial trade for the Brazilian state of Minas Geraes, and supplied much freight to the government-owned Central Railway of Brazil. Of the 288,671 tons of manganese ore exported by Brazil in 1915, the United States took 266,271 tons.

The export of gold bars, valued at $2,390,719, the annual output of the only two important gold mines in the republic—owned and operated by British capital—was greater than during either 1913 or 1914, and all of it went to Great Britain.

Monazite sand, exported almost entirely from the port of Victoria, state of Espirito Santo, from which is extracted the component thorium used in the manufacture of gas mantles, declined in 1915. The exports amounted to only 439 tons, or less than one-third the shipments in 1913. France, which imported more than 50% of the total in 1913, imported none in 1914 or 1915, the entire export going to the United States.—*Commerce Reports* of United States Department of Commerce.

War Tax Borne by Transvaal Gold Mining Industry

In an address delivered by W. H. Dawe, president of the Transvaal Chamber of Mines, at the annual meeting held in Johannesburg, Mar. 27, 1916, the following statement was made relative to the war burdens that are being borne by the Transvaal gold mines:

> At the last annual meeting reference was made to the subject of the special war levy of £500,000 on the profits of the gold-mining industry. The president stated that no protest had been entered against this special tax, as it had been made perfectly clear that it was not to be of a recurring nature. The chamber has now been notified that the government proposes to levy the same amount again this year on the mining industry, in addition to the ordinary profits tax. Your executive recognizes that the gold-mining industry has to bear its fair share of taxation, permanent or temporary, but submits that that is not the position which obtains. Last year the increased taxation, in addition to the special levy on the gold mines, was estimated at £1,464,000—that being the amount of the estimated extra yield from customs and excise and from the income tax. Thus, while the direct government revenue from the gold-mining industry was increased approximately from £1,500,000 to £2,000,000—or 33⅓%—the increase in the revenue borne by the rest of the country was approximately from £9,500,000 to £11,000,000—only 16%—and beyond question a large part of this 16% was also borne by the gold-mining industry directly and indirectly.

The Engle Furnace for Redistilling Spelter

By Robert H. Engle*

SYNOPSIS—An improved form of furnace designed for zinc redistillation is the result of the strong demand for high grade spelter since the beginning of the war. The design takes advantage of experience that has shown the desirable points to be incorporated. The form of furnace is described, as is also the kind of retorts used, methods of charging and discharging and the condensers used.

Ever since the beginning of the European War there has been an unprecedented demand for high-grade spelter, which has been met in part by redistilling common spelter and galvanizers' dross. The furnaces commonly employed for this purpose are uneconomical. An improved furnace designed, patented[1] and successfully used by me is shown in the accompanying illustration. This furnace was first built and developed in a dross smeltery at Trenton, N. J.

The illustration shows an eight-retort furnace. While a furnace of this type admits of several modifications, it has been found in practice that one of that size gives the best results as regards time, quantity and quality of product. The efficiency of this type lies, by reason of its construction, in the proper distribution of heat at vital points, where the maximum effect of fuel is obtained.

The retorts are grouped around a central stack having an upward draft, with flues of equal area and length leading thereto; hence if all the retorts are charged with the same grade of material, they will in practice usually finish at the same time.

The most effective point of heating is at the heel, or bottom, of the inclined retort. This is accomplished by a shoulder in the down-draft flue, running parallel with the bottom of retort, which deflects the flame against the retort and temporarily detains it by a contraction of the flue leading to the exit flue to the chimney. This feature is peculiar to this furnace, and therein it differs entirely from furnaces of the ordinary type. The retention of the flame at this crucial point, with its impingment against the bottom of the retort and the complete combustion of the fuel, is entirely due to proper flue construction. It is essential to keep the heel of the retort the hottest part in order to avoid the chilling of matte and heavy metals that constitute the impurities collecting there and the consequent formation of heavy crusts, largely iron, that tenaciously adhere to the surface of the retort and are with difficulty removed if allowed to harden; oftentimes at the sacrifice of a retort. Moreover, the accumulations of such crusts seriously handicap the heating effect and result in decreased production of spelter. The retort ordinarily used in this furnace is bottle-shaped and is made of graphite with a clay binder. The No. 8 size, ordinarily employed, will hold 750 lb.

The production of a furnace of the type shown may be generalized as follows: Eight retorts, each charged with 700 lb. dross = 5,600 lb., which is distilled in 18 hr., or 7,464 lb. in 24 hr. = 933 lb. per retort, with an approximate yield of 75% to 88% of high-grade spelter analyzing from 99.90% to 99.98% Zn. This duty depends somewhat upon the grade of dross treated—whether previously sweated (in which case iron is the dominating contaminant, lead being practically absent by reason of the liquation or sweating process), when the yield is low but the quality high; or unsweated, when lead predominates as the contaminant, and there is a higher yield on account of the dross not having been subjected to the sweating process, in which case the quality of the metal produced is dependent upon the skill and experience of the operator of the furnace.

Practice and Operation

In practice the furnace is operated in two shifts of 12 hr. each, two men on each shift, for the convenience of the furnace permits one man to look after four retorts, do his own firing, draw metal, etc. An overhead trolley encircling the furnace (not shown in the illustration) carries a supporting cradle in which rests a bottom-pour graphite crucible, whereinto the condensed metal is drawn from the condenser of each retort in succession, and thence poured into iron molds previously blackleaded, the bottom pour obviating the necessity of skimming. Hence the molten metal, generally drawn at a high temperature, never comes in direct contact with iron, for which it has a strong affinity, and is therefore uncontaminated.

This furnace in practice has done the best work with the use of a heavy bituminous coal (coke serving equally as well) low in sulphur, volatile matter and ash—a coal of the George's Creek or Pocahontas grade being admirably adapted for service. Such fuel, under normal conditions, is required at the rate of about 1,500 lb. per 2,000 lb. of dross or metal distilled. The furnace is adaptable also to the use of natural gas as fuel; in fact, a modification of it has been tried out on 18 charges, and in points of economy, cleanliness, regulation of temperature and ease of operation was found to leave little to be desired.

On the other hand, natural-gas firing has proved a formidable foe to graphite and most deleterious in its effects upon retorts of graphite composition, their life being shortened by at least 75%. This being considered, together with the high and ever-increasing cost of retorts, owing to unsettled conditions abroad, whence the materials used in their construction are obtained, it is expedient to protect the outer surface of the retorts with a flame- and gas-resisting compound that under continued heat will eventually glaze and offer the slightest friction to draft. In practice, even with the best of coal or coke as fuel, I have found a great saving in retorts by an application of a thin covering of infusible oxides in combination with silicates that form an efficient protection whereby the life of the retorts has been caused to average 65 charges; on the other hand, without this protection it has rarely exceeded forty.

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[1]U. S. patent, No. 1,180,118.

The retorts used in this furnace have an approximate composition of 68% Ceylon graphite and 32% of German clay as binder. The German clays are apparently given the preference over domestic or other foreign clays on account of their tenacity, thorough incorporation and refractory qualities. Since the beginning of the war the stock of manufacturers here has been exhausted and they have been compelled to substitute domestic clays, which after experimentation may be found to be equal to the imported article, but this is yet conjecture and in the meantime the user must take chances with the manufacturer. Should it be proved that our own clays are equally adaptable to this class of work, we shall have been taught a good lesson.

Somewhat less than five years ago a No. 8 retort (the size preferably used in this furnace by reason of its strength and efficiency) was purchased for $17.50 f.o.b. factory. Since then the price has soared until it is now almost threefold, and manufacturers are unable to fill orders within what used to be considered a reasonable time, owing to the unprecedented demand for graphite crucibles from the steel makers for the production of munitions of war.

The outside dimensions of a No. 8 retort (Dixon's number) are: Length, 35½ in.; diameter at neck, 8⅞ in.; diameter at bilge (or widest dimension), 20 in.; and diameter at bottom, 14 in. The thickness varies from 2½ in. at bottom to 1¾ in. at bilge and 1⅛ in. at neck. A perpendicular line drawn from the center of the bottom through the center of the neck would represent an inclination of 25°, as shown in the drawing. A molten charge of 700 lb. of metal or dross in a clean retort, will fill it to a level about 1½ to 2 in. below the inner bottom of neck, which is a sane and safe method of charging, for the ebullition of the metal will not then throw any of the unrefined charge into the condenser, which is situated on the outside of furnace and inclined at the same angle as the retort. Perfect heat regulation in this furnace permits an increase of 50 to 100 lb. over and above the usual charge without danger of contamination of the distillate; but this depends largely upon the skill and care of the operator.

Discharging the Retorts

The finish of distillation is easily discernible by the disappearance of the greenish-white flame at the vent of condenser, a small yellowish flame taking its place. The condenser is then detached from its luting with the retort, and all residues, accretions and crusts are removed with a long-handled hoe or scraper. This function, both as to safeguarding the life and efficiency of retorts and as to economizing fuel, is all-important. A negligent and inefficient furnaceman will produce metal of a nondescript character and lower the efficiency of retorts as well as the coal pile. In this connection it may be well to add that the average furnaceman is too much given to the butchering of retorts by the too ready application of sledge and bar, and prying upon the neck of the retort to remove crusts. The formation of crusts of undetachable nature is wholly unnecessary if taken in time. The retorts produced by reputable makers in this country leave little to be desired as regards quality, but none will stand abuse at the hands of the unskilled and careless operator.

When the market prices of construction materials were normal, say as recently as three years ago, it was possible to construct a furnace of the type herein described at approximately $100 per retort, or $800 for the furnace complete, equipped with retorts, ready to fire, with a liberal allowance for labor and material. Under existing conditions it would be wise to figure on an increase of at least 50%.

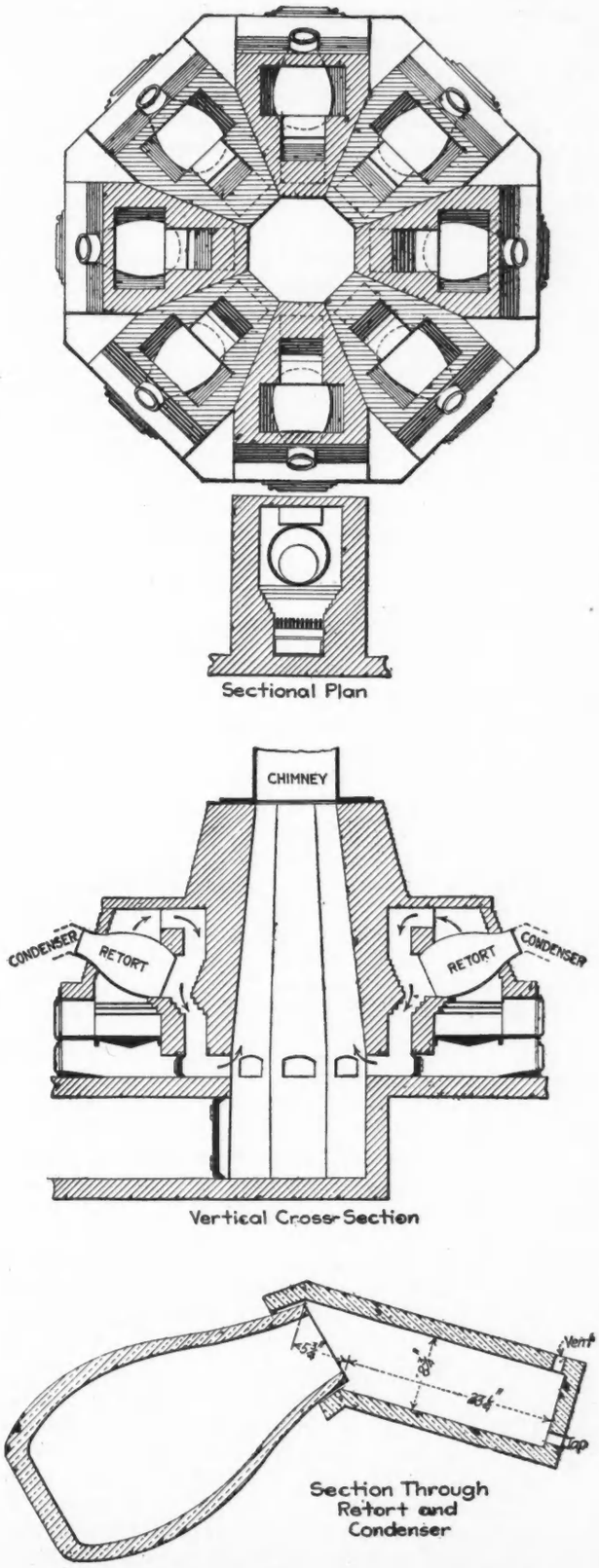
The Condensers Used

The bottle-shaped graphite retort was originally designed for retorting silver-zinc scum obtained from the desilverization of base bullion by the Parke's process. About 1895 this type of retort was used by me in the distillation of galvanizers' dross, in coke furnaces, and as condenser another retort of the same size was employed by sawing off the open end of same obliquely, some distance down, to fit over the neck of the retort and to incline at the same angle as the retort when luted on with a fire-clay mixture. This condenser was provided with a ½-in. tap hole at the bottom, which was plugged with fire-clay when in use, and with a vent hole, slightly smaller, immediately above. In order to minimize rupture and breaking of these improvised condensers it was found necessary to protect them with a reinforcement of hoop iron in the form of a cage, which was not only a clumsy contrivance, but also was expensive. Not long after this I devised a condenser of cylindrical shape, composed of chamotte with a raw fire-clay binder and had the original model made by the Tacony Crucible Co., of Philadelphia. This new form, by reason of its easy shape to fit, lent itself very readily to the protection of a jacket made of sheet steel, hinged longitudinally and opening in halves, and would outlast several condensers, hence could be used over and over again. Unfortunately I failed to secure patent protection, and this pattern of condenser has been adopted by all distillers of zinc dross. It may be described as having a thickness of walls of 1½ in., a bottom of 2 in., internal diameter of 9 in., extreme length on top of 33 in., extreme length on bottom of 27 in., with a tapered or funnel-shaped opening of 10½ in. for attachment to retort, allowing about ¾ in. all around for luting on. Both smaller and larger sizes of condensers than the dimensions here given have been tried out, on the same size retort, with more or less negative and unsatisfactory results, so it would appear that the dimensions given satisfy working conditions. A condenser of the same composition as the graphite retort, made by Dixon or Bartley, will give much better results, inasmuch as it is less absorbent and less likely to crack and lose metal, but at present its price is prohibitive, unless it is used by exceptionally careful furnace operators, in which case it will outlast five or six fire-clay condensers, than which it is easier to clean and far more satisfatcory in every way.

Cadmium Recovery

In the distillation of the residual dross (galvanizers') from Prime Western spelter containing more or less cadmium it is sometimes profitable to save the cadmium. That may be done almost completely by heat control by a fractional distillation performed as follows: After the retort has been charged, the charge melted down and the condenser luted on, there emanates first from the vent moisture in the form of steam, shortly followed by a deep-brown smoke, which represents the partial combustion of organic matter; following this, and shortly preceding the characteristic green-white flame of zinc, will

appear the light-brown fumes of cadmium oxide. At this juncture, if that metal is to be saved, the vent is partly closed and the heat controlled to permit a condensation of cadmium in conjunction with the zinc vapors, forming an alloy that practically decadmiumizes the charge in the retort. The major part of the cadmium will be collected in the first drawing of metal, usually contained in a slab of about 50 lb.; the second drawing seldom contains more than 0.0045% Cd. The first drawing is put aside for redistillation and is subsequently enriched by repeated treatment, without appreciable loss of either metal, until cadmium form the principal and zinc the negligible factor in value.



ENGLE ZINC-DISTILLATION FURNACE

Qualities Required of Concrete to Resist Action of Sea Water*

In order to construct concrete that will have the greatest resistive power against the action of sea water (and also probably of alkali waters), it must possess especial characteristics. The addition of puzzolan in some form is widely practiced in Europe and appears to be theoretically correct. It has not been tried in America, to the author's knowledge, but is worth an exhaustive test. The amount should not be over one part for each part of cement, nor less than one-half part.

Waterproofing with substances that combine chemically with the free lime ought to be successful and is worth testing. Between the extreme limits of high and low tides the concrete surfaces should be faced continuously, without joints, with about 3 in. of 1 : 1½ or 1 : 2 mortar, made with sand as specified below, well cured before coming in contact with the sea water. Facing must be placed simultaneously with the backing. The cement should be low in lime and alumina and contain as little gypsum as possible.

Sand must be siliceous, uniformly graded from fine to coarse, with not less than 50% nor more than 70% passing through a 20-mesh sieve and not more than 3% passing a 100-mesh sieve, and must have no organic matter coating the grains. It must be free from roots and easily disintegrated grains, such as feldspar, shells, limestone and mica. It should be washed free from clay and should show a tensile strength for 1 : 3 specimens not less than the following percentages of the strength of Standard Ottawa sand of the same consistency, using the brand of cement that is to be used on the work:

Age	Strength, %
1 day	85
3 days	90
7 days	95
28 days	100

Where concrete must be exposed to sea water without mortar facing, gravel should not be used. Broken stone should be hard, durable trap, granite or other dense, hard, insoluble stone. It should not exceed ¾ in. in size and should be free from crusher dust, sand, dirt, organic matter or other foreign substances. Mixture should be 1 : ½ : 3 or 1 : 2 : 4, or should be proportioned for maximum density.

Pure, fresh water should be used in sufficient quantity to permit the materials to be well puddled and spaded, so that no later surface treatment or patching will be required, but not sufficient to materially retard the setting of the cement. Care must be exercised, however, to prevent the formation of laitance or pockets of neat cement or very rich mortar. Forms should be tight to prevent leakage of cement or, where concrete must be

*Extract from a report by W. Walters Pagon, submitted to J. E. Greiner and printed in the "Journal" of the Engineers' Club of Baltimore.

submerged immediately, to prevent contact with the sea water.

The facing should be reinforced with steel well covered with mortar and securely anchored to the backing. No surface treatment should be given. The work should be allowed to harden two weeks, if possible, before coming in contact with sea water. Two months is better. Sea-water work should never be done in cold weather, with temperature below 40° F. Where possible precast, mortar-faced blocks, cured in damp sand for at least one month, should be used. The facing should extend back at the joints to prevent saturation of the backing. The joints should be pointed with 1:1 mortar of coarse sand. The most durable surface will be obtained if granite or other dense stone be used as facing. This should be not less than 6 in. thick, anchored back with wrought-iron clamps and pointed with 1:1 mortar of coarse sand and cement as already noted. On mortar or concrete surfaces the growth of barnacles, moss, etc., will frequently afford protection. This has usually been considered destructive, but really acts as a protection.

All of the foregoing can be sumarized into these statements: Use materials that cannot be attacked by the sea-water salts; mix these so as to obtain the maximum density; have no stones near the surface of concrete but use mortar face 3 in. thick.

Calumet & Hecla Celebration*

At the Calumet & Hecla 50th anniversary celebration Major Henry L. Higginson, who was one of the principal speakers, said in part:

Fellow countrymen—born in many countries but now all Americans—I am glad to meet you. I am one of the few men who saw the beginning of Calumet & Hecla and who have been with it ever since. There are not many of us left. You are the men who have made this wonderful corporation, who have made it what it is physically and morally. You have done it by working together.

It was in 1869 the last time I was here. Mr. Shaw was working in a little bit of a house, and there was no promise then of the great community I see today. Mr. Shaw had help in developing his company, and not the least help was from John Simpkins, who sold the copper. You cannot get far with a copper mine unless you sell the copper.

It is useless to talk to you men about this mine. You have made it the tremendous success that it is. The officers and men have always worked together. In the early days there was need of money and Mr. Agassiz had to get help from many friends, but the help you gave him was the greatest help of all. You will remember that he was never content with what the mine had in the way of machinery. He always wanted the best, and it is for this reason that you have today the wonderful machinery that is yours to work with.

This has always been a family company. You and the officers have been the family, and you know now a member of the third generation of Shaws who is working with you. Mr. Agassiz, your president, is of the second generation of his family. The Calumet & Hecla, officers and employees, always has been a great family. That is the good of the whole thing. The officers and men have worked together, and that is the best thing of all.

The officers have given you comfortable homes, good schools, libraries, bathhouses, all the comforts. You have in return given your best services, your loyalty. You have done your share and they have done theirs. It is a splendid example of teamwork.

A few men wanted to meddle in your affairs a couple of years ago. You told them to go away, that you wanted no meddlers in the affairs of the Calumet & Hecla family. Then came hard times through the war, and you promptly told the officers you would help by accepting half time for a while. Then came good times and the officers remembered you. I cannot repeat too often that it is the relations of the men and officers of this company that have made it what it is.

My father was a director in the beginning of this family. His father succeeded him. When our family quits the Calumet & Hecla, we will let you know beforehand.

No one not of the family can realize the labor that has brought this great corporation to its present stage of prosperity and success. I do not mean the labor of the men seated behind me nor the labor of you men, but the labor of both; one would have been no good without the other. That is the way you have succeeded. And I am proud also to remember that you are all Americans, no matter what country you may have come from. This is your home now, it is our home, it is for us to look after it.

Think of the old countries across the water. There homes have been despoiled, industries have been wrecked and there is nothing to work for. Suppose that should happen here? You must be ready to help and to defend your country when she is in trouble. Get ready.

Suppose 500 new and untried men came here to work. They would ruin the mine in a week. They would have to be trained to be effective members of our family. So must soldiers be trained. A dozen men working together are strong; separated they are weak.

Remember to keep high your ideals as citizens and as Calumet & Hecla men. Remember your country and leave the rest to God.

*"Boston News Bureau," July 19, 1916.

Argentine Tungsten Deposits

In the western provinces of Argentine, the wolframite deposits of the Andes continue to be worked on a small scale, according to "Commerce Reports" of the United States Department of Commerce. Ore is extracted largely by individuals and carried considerable distances on muleback. In certain regions, owing to more favorable communications, Argentine mining products are exported by way of Chile. The great distance from the coast and the difficulty and expense of transporting ore and supplies have in most instances made operations undertaken on a large scale by foreign companies unprofitable.

The Hansa Sociedad de Minas, which works wolfram deposits in the province of San Luis, resumed operations during the latter part of 1915, after suspending at the outbreak of the war. During 1915 Argentine exported 158 metric tons of wolfram (65% WO_3). Exports in 1914 amounted to 394 tons, and in 1913 to 536 tons. It is interesting to note that while the export value of wolfram was placed at 4.38c. per lb. in 1913 and 1914, it was valued at 40.35c. per lb. in 1915.

Mining Ore from Pillars

By H. H. Hodgkinson*

SYNOPSIS—A method of removing ore from pillars, by means of which a much greater quantity is recovered than by the processes formerly used. The pillars are crosscut and top-sliced, the ore being drawn through chutes.

To devise and carry into effect a mining system that would permit the extraction of a high percentage of the orebodies with safety and economy, a method was introduced at the New Jersey Zinc Co., Franklin, N. J., which is really a combination of two old systems—transverse stope slices, beginning at the bottom of the orebody and raising by shrinkage stopes from level to level, drawing the broken ore and filling the open space with waste, and repeating the same performance from level to level, thus leaving pillars from 30 to 50 ft. wide between the slices. To win these pillars the ordinary top-slicing system was applied. There is no patent or special secret process connected with the system, which has now been in daily operation for several years with perfect satisfaction.

In the case at hand the ore was produced by means of back-stoping slices 17 ft. in width, which were carried transversely across the vein from foot to hanging wall and upward, to a height of 50 ft., the operation beginning at the bottom of the orebody. A pillar of ore averaging 35 ft. in width was left between each stope slice. After the ore allotted to be mined by the stopes at one extremity of the orebody was removed and the stopes filled with rock filling, the work of extracting the ore from the pillars in that section was begun. The operation started at the top of the orebody, mining the ore on downward, slice after slice, allowing the rock filling to cave from above and from adjacent stopes on the sides as work progressed.

Top Slicing and Shrinkage Stoping

The method here described for removing ore from the intermediate pillars is a combination of both the shrinkage stope and top-slice methods, devised by R. M. Catlin and developed by me with the object of giving a larger and more uniform production of ore from the pillars at a lower cost than if the pillars were mined exclusively by the top-slice method. When the ore is removed from the pillars entirely by top-slicing, only a limited tonnage is produced daily from each working place in ground that does not cave and break up into small pieces readily, as only a comparatively small tonnage can be broken and removed at one time, all of which must be shoveled and handled twice before it arrives in the ore chutes in the pillars. This is naturally slow and expensive, unless a great many raises for ore chutes are driven to handle this ore, which would likewise be a matter of considerable expense, as tramcars are in most cases impracticable. Then too, set timbers must be placed from time to time to support the timber mat left exposed by the removal of the ore, which means that both the drill runners and muckers must stop their work of production to erect these timbers, the supply of ore being temporarily stopped. The sublevels used in this case are 10 ft. apart and the slices 10 ft. as it was found the ore did not cave or break up small enough to be easily handled through the set timbers in the sublevels; quite different from mines where the ore is soft and caves readily, which permits the sublevels to be placed 14 ft. or more apart, a large portion of the ore in each slice being removed from above the set timbers in the sublevels.

The method here described was planned with the idea of top-slicing 77% of the ore in the pillars after 23% of it had been mined by a shrinkage-pillar stope carried up through the middle of the pillars, which will then permit not only a larger and more steady production of ore from the portion top-sliced, but will aid materially in reducing the cost of that ore. In addition the 23% mined by the shrinkage stope in the pillar does not cost much more than the ore mined in the regular stopes. Inasmuch as the pillars, as stated previously, average 35 ft. in width and extend from foot to hanging wall, having a vertical height of 50 ft., the crosscut *M*, Fig. 1, 10 ft. high and about 8 ft. wide, was first driven through the pillars across the vein so as to leave 13½ ft. of ore on each side. Let us assume that the vein has a width of 120 ft. in this case. The two 4x4-ft. raises should then be erected in the 13½-ft. pillars from two short drifts, as shown in Figs. 1 and 3, at an inclination of from 50° to 60° with the horizontal until the timber mat above is reached. One raise has been used successfully, but two are better, as will be shown later, since they give more points from which to attack the pillar. Small crosscuts, 5x5 ft., are then driven from the raises at convenient intervals, preferably every 10 ft., since the slices are 10-ft. slices, toward the center of the pillar and only far enough so that the pillar stope when brought up will hole through these crosscuts and thus afford entrance and exit to the pillar stope after the chutes in the set timbers in the pillar stope are full of broken ore and are no longer available for this purpose.

Short Crosscuts Started and Bratticed Off

As the back-stoping proceeds in the pillar stope and the level of broken ore rises, these small crosscuts are bratticed off to prevent the broken ore from running in the raises. These short crosscuts also serve as suitable places from which to start each successive slice. In the meantime the work of erecting set timbers and the placing of broken ore behind them in the crosscut *M* is progressing, and when finished, chutes are installed in the set timbers for the removal of the excess ore from the pillar stope in tramcars. The two raises *C* and *D*, when finished, are equipped with ladders and air lines and are not used as an outlet for ore from the pillars. The work of mining the 8-ft. pillar stope is begun from on top of the set timbers, which are covered with lagging. The pillar stope is mined up by back-stoping through the pillar until the mat is encountered, as shown in Fig. 4, the miners entering and leaving by means of the short crosscuts *K* and the raises *C* and *D*, Fig. 2, in the new pillar *A*.

When the pillar stope has been finally mined up to the mat, the broken ore is lowered a little below the level of the first slice ,as shown in Fig. 1, and as the broken ore moves down, the sill timbers *S* are placed in hitches on the sides of the new pillars *A* and *B*, which later serve as

*Mining Engineer, New Jersey Zinc Co., Franklin, N. J.

caps in the next slice, as *S*, Fig. 1, to support the timber mat, the caps being supported by 10-in. legs, as shown.

The work of pulling the muck down begins at the small crosscuts *KK* from the raises and progresses in both directions from each raise, as shown in Fig. 4, being closely followed by the method of timbering just mentioned, until the mat over the pillar-stope is entirely supported. The work of top-slicing the new pillars *A* and *B* is then started by one crew of men at the foot-wall and another at the hanging-wall end of the pillars, retreating respectively in the direction of the raises *C* and *D*, caving to time as it is encountered in slicing the new pillars *A* and *B*. As the ore is removed from each successive slice, a new mat of lagging is laid down on the sills over the pillar stope and across the floor of the new pillars; the broken ore is also lowered in the pillar stope to accommodate the ore from the next slice after the timbers and fill from above have been caved, the sills *S* being propped so that the new mat is safely supported by the broken ore in the pillar stope, thus relieving the timbers from this excessive strain later. This is the same as the condition indicated in Fig. 4. The mat rests upon the broken ore,

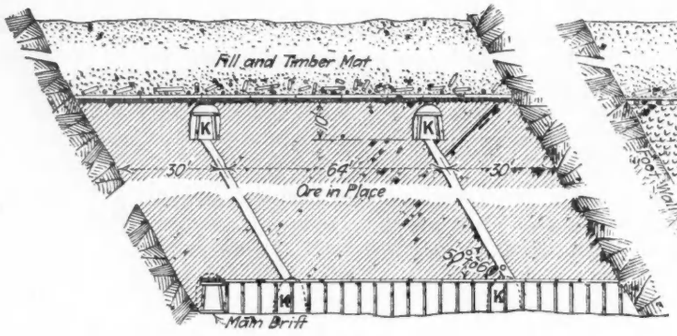


FIG. 3. SECTION THROUGH RAISES IN NEW PILLAR "A"

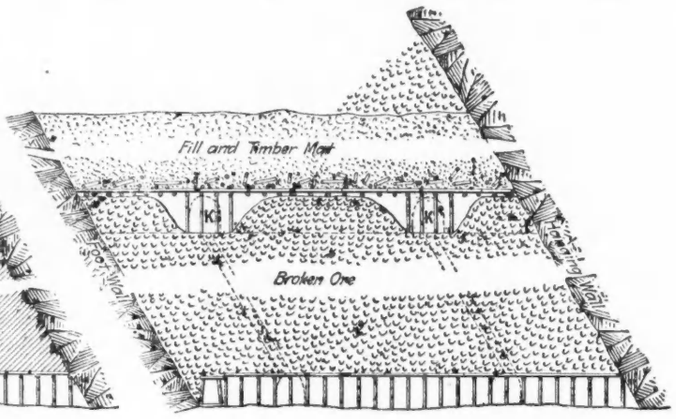
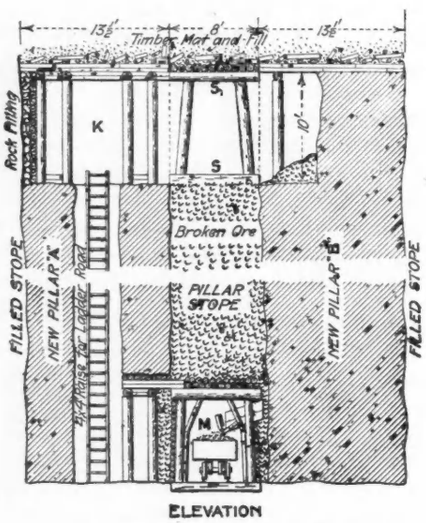
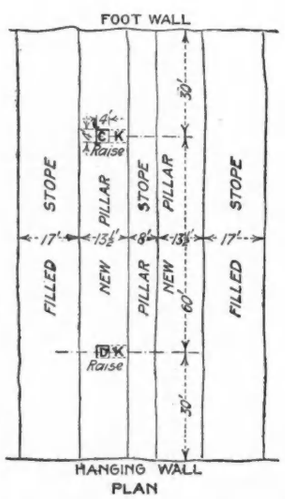


FIG. 4. SECTION THROUGH PILLAR STOPE, SHOWING CAVING ON BROKEN ORE





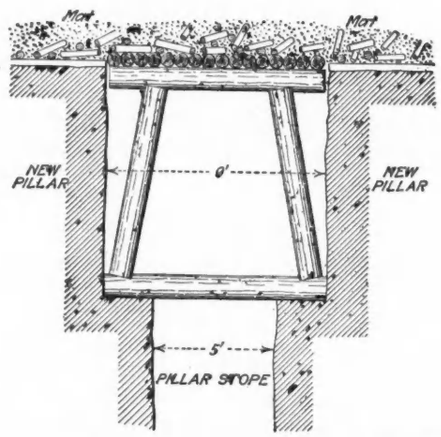


FIG. 1. SECTION OF PILLAR STOPE FIG. 2. PLAN OF PILLAR STOPE FIG. 5. MODIFICATION OF PILLAR STOPE

the set timbers as they retreat until the raises are reached. In addition the work of top-slicing may also be begun at the point *X*, Fig. 2, midway between the raises, proceeding in both directions, each crew again retreating toward its respective raise, the set timbers being blasted down and the filling caved as before.

The essential of this method lies in the fact that the pillar stope must be left full of broken ore to within a few feet of the slice being worked, for the purpose of supporting the two new pillars *A* and *B* on the inside and thus prevent them from crushing in. The outside surfaces of these pillars are already firmly supported and held intact by means of the rock filling placed in the two adjacent stopes. This filling by the way, is breasted off from time which supports it temporarily the same way that it would if the mat and fill from above were caved.

Besides supporting the new pillars, the pillar stope serves as an outlet for the broken ore produced from the new pillars instead of using raises. This not only makes it possible to break the ore in the new pillars in such a way that a large percentage will fall directly into the pillar stope without being handled, but permits the portion of broken ore which must be handled to be shoveled directly into the pillar stope, which in this capacity serves as a big ore chute with a large reserve, extending from one end of the pillar to the other and easily accessible for the removal of ore from any point of the two new pillars *A* and *B* and the pillar stope itself. The broken ore in

the pillar stope is lowered from time to time to allow the ore from the top-slicing of the new pillars to be thrown in the pillar stope. This also accounts for the method of supporting the mat over the pillar stope, whereas if the set timbers rested upon the muck, the ore could not be lowered until the slice was finished and would necessarily have to be heaped up in the pillar stope, adding unnecessarily to the cost without giving any particular advantage. The pillar stope also serves as a traveling road from one end of the pillar to the other after the ore has been lowered and the mat securely supported.

Raises driven at an angle of from 50° to 60° seem to be both the most economical and safest for making into ladder roads, which would save the increased cost of raises at a flatter angle because of their additional length. Then again, long flat raises would have a tendency to weaken the pillars somewhat. Two raises permit much better ventilation in the pillars; the smoke and gases after blasting are removed much quicker than if a single raise were used, thus permitting the miners to return to their work sooner. Then too, it seems best to have two raises arranged so that the miners are but a short distance from their work, there being one in case the other should ever become blocked off and inaccessible, as shown in Fig. 2; here the miners are never more than 30 ft. from their respective raises. A 4½x4½-ft. raise affords ample space to permit timber, drills, steel, etc., to be brought up into the slices and does not affect the pillars *A* and *B*, which are supported firmly on each side, as stated previously. The practice is, however, aways to drive the raises before putting up the pillar stope.

Advantages and Disadvantages of This Method

In conclusion, the advantages of this method over the regular top-slice method for mining a 10-ft. slice are: (1) Minimum handling of broken ore; (2) cheaper production of ore; (3) larger output and complete recovery of ore; (4) small number of raises required for men and supplies only; (5) easy access to all points in the pillar; (6) no drifting or crosscutting necessary on each slice; (7) immediate production of ore from surplus of pillar stope; (8) more points of attack in mining ore from pillars; (9) a more uniform production of ore; (10) good ventilation; (11) safe retreat in case of danger; (12) cars and wheelbarrows unnecessary for handling ore; (13) men and ore do not use same raise.

The disadvantages are: (1) Time and expense of cutting hitches for sills in pillar stope; (2) an occasional breakage of sills in pillar stope; (3) a reserve of broken ore temporarily tied up in pillar stopes.

Where any great difficulty is experienced, owing to the breakage of sills in the pillar stope, I suggest that the width of the pillar stope be reduced from 8 to 5 ft., thus permitting the legs of the set timbers to be supported directly by the ground on each side, as shown in Fig. 5. This of course would necessitate enlarging the pillar stope by side rounds to 9 ft. at each successive slice at the time of erecting the set timbers, making a ledge as shown in Fig. 5, upon which to place the sill, thus saving considerable time and labor in cutting hitches. By reducing the size of the pillar stope, a large percentage of the ore in the pillar stope would be taken out by top-slicing instead of by the pillar stope, which would be an advantage in case of pillars, as the new pillars would then be 15 ft. in width.

How To Sell a Mine

The following is reprinted from the *Journal*, Aug. 29, 1908. The intense activity in the mining business at present, with the attendant feverish offering of mining properties, makes the article particularly apropos; although written eight years ago, there is nothing new to be said on the subject and this article tells the whole story now as it did then.

We might perhaps entitle this article "How to Sell a Mine, and How to Finance Development Expense." We receive many inquiries of this character, which we are obliged to answer, as we feel, in an unsatisfactory manner, but we do our best to aid our correspondents. The man who tries to sell a mine or to secure money to continue the development of one is not necessarily aiming to fleece the unwary investor. On the contrary, we prefer to believe that most men are honest and are endeavoring to do a legitimate business. What then can be done to assist the honest owner of mining property who is seeking capital?

Here is a letter recently received, which is a type of many: "Please give me the names of two or three brokers in New York who make a specialty of handling mining stocks and bonds; also names of promoters of mining property."

Another correspondent, whose letter was received in the same mail, desired to have the names of half a dozen good bond salesmen, who might be able to market the stock of a mining company. Both of these correspondents little knew what they were asking. There is an erroneous impression that there is in Eastern cities, particularly New York, a market for mines wherein they may be sold as real estate is sold among the board of real-estate brokers. If there be any such market, we do not know of it.

Nevertheless, there is an active market for mines among the houses that make a business of the development of mineral property, such as the Guggenheim Exploration Co.,[1] the General Development Co., the Mines Selection Co., the Venture Syndicate and several others. These companies are constantly on the watch for good mining property; indeed they do not wait passively for such to be brought to them, but they send out agents to find them. Any property presented for their attention receives careful consideration if it shows merit.

However, when we refer to these companies, the man who asks us how he can finance his mine is apt to draw a long face, and remark: "It is useless to go to them; they will not consider my property unless I will give them the whole of it, and they will not be willing to pay me what it is worth." Now in this respect we do not suppose that the big mining houses are very different from anyone else in the business; everyone aims to drive the best possible bargain. Furthermore, there are few, if any, mining houses that will not insist upon the control of the property that they are going to undertake.

The market for mines is not confined to the big houses. There are many smaller mining syndicates that do not figure so prominently in the public eye. Most of these are represented by a consulting engineer, who advises as to the purchase and operation of mining properties. It is therefore a good plan for the man who wants to sell his mine to address some of the well-known engineers (whose names and addresses are to be found in the professional directory published weekly in the "Journal") and inquire if any of their clients would be interested in what is offered. If the property offered is meritorious, the vendor may be fairly sure of developing interest in this way. But again, he must be prepared to surrender the control of his property and also he must not expect to receive for it any more than it is worth.

This then is the real mining market, and when we have told about it, we have given the best advice and assistance that we can. Any other species of mining market is amateurish or dishonest. By amateurish we mean this: An owner of a mine comes East to raise money, and putting up at the Waldorf, aims to make the acquaintance of some person of means who will be attracted by the vision of great profit. (We refer to the Waldorf merely as an illustration; practically, its opportunities for such business are said long since to have ceased to be good.) After the failure that results nine times out of ten (or 99 out of 100) such persons have no further interest in mining. They are the amateurs. The sharks are the persons who seek anything—a mine, an invention, a manufacturing scheme—that can be offered attractively to the gullible public. Neither the amateur nor the shark has anything to do with the real mining market, although both buy mines, or alleged mines.

[1]Since this was originally published the corporate existence of some of these companies has changed.

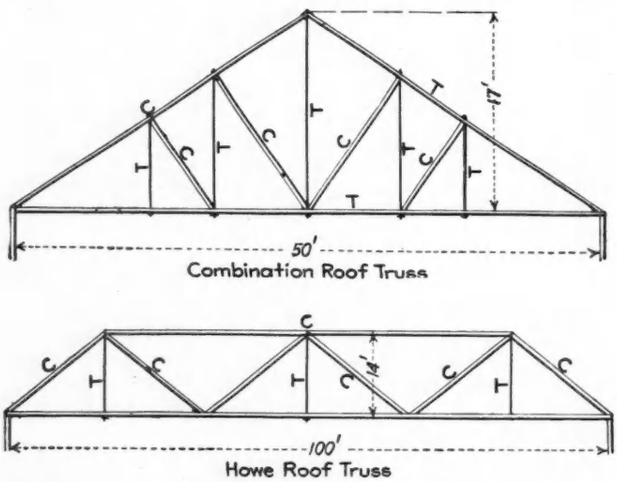
Details of Practical Mining

Timber Roof Coverings

By Frederick W. Foote

The covering of the many sheds, shops and buildings incident to the modern mine plant is important. The covering of sidehill mill buildings will not be discussed, as that comes more in the province of mill design. Buildings up to 12 ft. in width can be conveniently covered with what is commonly known as "shanty" roof, supported on 2x6-in. or 2x8-in. rafters laid on the top plate. Buildings up to 20 ft. in width are easily covered by an "A" roof made of 2x6-in. rafters and a 1x6-in. ridgeboard. Tie-rods or ceiling rafters keep the top plate from spreading. Buildings having a width between 20 and 50 ft., that do not permit the location of intermediate posts, are best covered by what is known as the combination roof truss, illustrated in Fig. 1. Trusses of this type are built up of timber and iron rods. The diagonal members, being subjected to compressional forces, are made of timber, while the vertical members, being in tension, consist of iron rods.

For spans between 50 and 100 ft. the Howe truss, shown in Fig. 2, is used. This is built up similarly to the



FIGS. 1 AND 2. TRUSSES FOR 50- AND 100-FT. SPAN

combination truss, but entails less room under the eaves. One hundred feet is about the limit of timber roof trusses for ordinary use. The combination trusses up to 30-ft. span can be assembled on the ground and hoisted into position by a gin pole. In doing this care must be taken to lift the truss in a sling going under the bottom chord. Recently a truss of this character weighing between two and three tons was being lifted into position by a sling placed around the apex, and when about 20 ft. from the ground, the bottom chord failed, allowing the whole truss to come to pieces. Luckily no one was hurt, but the example is instructive. The weight of the truss (two to five tons), being applied upward at the apex when it is normally applied downward at the extremities, caused a reversal of the internal forces. The lower chord was thus put in compression, with the attendant failure.

Howe trusses of 75-ft. span were found to be too heavy to be conveniently placed by means of a gin pole. Two stagings were built about 3 ft. lower than the height of the bottom chord, on either side of its location. The lower chord was assembled on the floor between these stagings and hoisted into position and supported by blocks placed on top of the stagings. While this was being done, another secondary staging was built on top of the first one toward the next truss to be erected. This is built up to within a couple of feet of the upper chord, and the upper chord and diagonal members are assembled from these two working platforms. The vertical rods are tightened up so that an arch of a couple of inches is present in the lower chord before the blocks are removed. When this is done, the weight of the truss reduces this to about an inch. The further weight of the roof brings the lower chord about flat. When the truss has been set, the staging is moved over to the next location—the far-side staging being low enough to pass under the lower chord of the truss just completed. This method is continued until the last truss is set.

There are two general methods of covering the roofs of wooden buildings, the choice of which is regulated by the permanency of the structure. The cheaper method consists in covering the rafters with 1-in. boards and some form of roofing or asbestos paper. This costs in the neighborhood of $45 per M sq.ft. in place. Corrugated galvanized sheets make a good roofing. These sheets are laid over 1-in. furring and cost about $60 per M sq.ft. in place. The latter of course lasts longer.

Tar-paper roofs, if properly laid, are water-tight for a couple of years, but if improperly laid, will leak during the first fog. The following details are well to observe: Sweep the roof covering of 1-in. boards carefully before undoing the roll of paper. Lay the paper horizontally and not vertically. Starting about 1 ft. below the ridge, tack a strip on each side of the ridge for its entire length and then put the ridge paper on, tacking it down with "tin dishes" every 3 to 4 in. This ridge piece will lap the first strip by about 6 in. A small tin of a rubber preparation is usually included with rubberoid, while an asphaltum paint is given with tar papers. This should be used on all joints. Each row of paper should lap its successor by at least 2 in., and the work should proceed from the ridge downward so that it is not necessary to walk on the paper after it is laid.

The use of short lengths of paper should be reduced to a minimum, but where used the cut should be made on a diagonal and the ridge side overlapped. Any stack holes, etc., should be well flashed with galvanized iron. Paper is made in 1-, 2- and 3-ply tar paper, rubberoid and asbestos. At least 2-ply or rubberoid should be used for roofing, and asbestos is preferable in a region where forest fires or sparks from stack emissions are possible.

If a more lasting roof is required, 18-gage corrugated galvanized sheet iron laid on 1-in. furring strips is used.

This is laid very much the same as large shingles, allowing an overlap on the sides of one corrugation, and at least 3-in. on the end laps. Nails should be put in the ridges and not in the depressions, as this tends to greater dryness. A ridge roll can be bought in lengths and fitted to the proper length.

Blasting for Steam Shovels*

The well or churn-drill method of drilling a quarry or opencut face is now common, and the use of large drills is constantly increasing. In fact, the growing tendency is to use large machinery of all kinds such as mammoth crushers, steam shovels, etc. Volume is what is wanted nowadays.

In this method usually holes of from 4- to 6-in. diameter are drilled the full depth of the face from 15 to 20 ft. apart located about as far back from the face, and the whole face shot down at one time. The cost of drilling may vary all the way from 20c. to 75c per ft., and in extremely hard rock up to $1.50 per ft. In the flat laminated rocks of the Middle West as much as 75 ft. of the hole can be drilled per day, while in the harder pitching rocks common in the East, from 25 to 40 ft. per day is considered good.

These well or churn drills are best adapted to work where the strata are flat and the height of the face exceeds 25 ft. When used in the harder rocks, it is best to drill a 5⅝-in. hole because it is possible to concentrate more explosive in the bottom, where it is usually most needed, and the larger hole permits a greater spacing interval and thus a minimum drilling cost results. In softer rocks, such as shale or sandstones or even in some limestones, when working a shallow face, it may be more economical sometimes to use a 4- or 4½-in. bit, because not so much concentration as distribution may be desirable and a considerable saving of explosives can be made. A 5⅝-in. hole requires about 15 lb. of dynamite and a 4-in. hole only about 7½ lb. per ft. of hole.

Spacing of holes depends on the character of the material and the depth of the face. A nice spacing for holes 35 ft. deep is about 12 ft. apart and 15 ft. back. Holes 60 ft. deep can be spaced 16 ft. apart by 20 ft. back, and holes 100 ft. or more deep, 20 ft. apart and 25 ft. back in most rocks. It is rarely advisable to space more than 20 ft. apart.

Holes should be drilled 3 or 4 ft. below the quarry floor, unless there is a natural parting at that level, in which case, if holes are sunk to grade, the bottoms will come clean. Going below the floor insures better breakage, cleaner floor and permits easy access for a steam shovel.

No rule can be given as to the amount of dynamite to load in holes of given depth as all depends on local conditions. The important part is the selection of the proper explosive to produce the desired results. Explosives differ widely in their action, and what would suit one condition may not fit another.

Before loading it is usual to calculate the number of tons or cubic yards available in the blast, and then to get about 5 tons of rock per pound of explosive, varying the load per hole according to the burden or local conditions.

In deep holes considerable saving can be made by breaking the load two or three times, with equally good results. The object in breaking the load, besides saving explosives, is to distribute the charge where the rock is hardest, skipping seams and weak points where it is not needed. It is good policy to arrange the breaks so that they are not all on the same level. This amounts to the same thing as shooting two or more benches simultaneously.

In loading deep holes there is little gained by removing the paper and loading the dynamite loose, or in bulk. In fact, the danger is increased by so doing, as loose powder may be scattered all along the walls of the hole and at the mouth. When this occurs, there is danger of a rock working loose, getting wedged between the tamping block and wall, causing friction and setting off the charge.

As a usual thing well drill holes are driven and blasted in one line, holes being equidistant from the face. Occasionally in very hard ground better results are obtained by staggering the holes. There is also another method known as "buffer" shooting, or shooting against the bank. By this is meant that a line of holes is shot down and then another line drilled and blasted before the débris from the previous shot is removed. This method is well adapted to use in limestone formations where the strata are flat and thinly laminated on top. It is necessary only to loosen or push out the bottom in such a formation, thus eliminating the necessity of lifting and laying tracks or moving the shovel so frequently as when the clear bank method is used.

In hard rocks a combination of 60% and 40% dynamite is recommended. A little 60% should be loaded in the bottom of each hole and 40% used on top. In softer flat limestones a 40% explosive will usually be found strong enough and often a lower grade can be used for top load. If the work is very wet and the toe heavy, it may be necessary to use a gelatin dynamite from 40% to 60% strength.

If holes are double- or triple-loaded at least two electric blasting caps should be used in each charge unit to assure thorough detonation and to afford a way out in case one should be broken or otherwise spoiled during tamping. Electric blasting caps with duplex wire leads have been found a great convenience in loading deep holes. They are handier, stronger and better than those with two single leads. Oftentimes short-length electric blasting caps are used and connecting wire spliced to make the necessary length. A good scheme followed in one big operation is to use wires with colored insulation, splicing a red wire to one leg and a blue to the other. When final connections are made—parallel method—the red wires are connected to one lead and the blue to the other. There is no chance of a mistake if this is done.

*Excerpt from an article by S. R. Russell, in "Du Pont Magazine," August, 1916.

As a Prevention Against Fire being communicated from the surface plant underground, or vice versa, a section of the shaft timbering on the Proprietary mine, Broken Hill, Australia, is cut out just below the surface chairs; heavy plate-iron doors are hinged to the sides and can be closed at short notice. Like all the safety appliances, these are thoroughly tested periodically to insure their efficiency when needed. In conjunction with these, plate-iron doors are provided at all approaches to the shafts to control the air currents in case of fire, according to E. J. Horwood in a paper presented at the February, 1916 meeting of the A. I. M. E. in New York.

Test-Pit Sampling of Placers

By Harley E. Hooper

The chief characteristic of the alluvium worked for wolfram in lower Burma is the large number of schist and quartz boulders ranging up to two or three tons in weight interspersed in a sticky yellow clay. The latter is a product of the decomposition of the schist, and as a general rule, the greater the number of boulders the richer is the ground. The depth of the wash varies from 3 or 4 ft. on the hillsides, to 60 or 70 and even to 100 ft. on the flat country, with a water level on the flat country about 30 to 40 ft. down.

For preliminary sampling the ground is usually surveyed into squares of 5-chain sides and a shaft sunk on each intersection. If the sampling results warrant it, intermediate shafts are put down. The shaft sinking is done on contract by Chinese coolies, a typical rate being, for the first 10 ft., 10 annas per foot; for the second 10 ft., 12 annas; for the third 10 ft., 14 annas; for the fourth 10 ft., 1 rupee[1] per foot; for the fifth 10 ft., 1 rupee 8 annas; for the sixth 10 ft., 1 rupee 12 annas, and for the seventh 10 ft., 2 rupees 8 annas per foot. Should water be met with an extra rupee per foot is paid for sinking below water level.

Primitive Methods of Pit Sinking

Owing to the impervious nature of the alluvium, it is usually quite possible to sink 15 or 20 ft. below water level without requiring a pump or other means of removal for the water, the bucket bringing up 20 to 30% of water with its contents. The shaft-sinking rates allow very high wages to be made in favorable ground in order to compensate for the low earnings when a boulder is struck that requires explosives.

The shaft sinker starts by marking out a circle from 2 ft. to 2.5 ft. in diameter and squatting on the ground, works with a small pick having a handle about a foot long, putting the dirt into the bucket with a small basin or half a cocoanut shell. Working thus in a circle, he sinks from 12 to 18 ft. the first day if in favorable ground. An ordinary household bucket is used for hoisting by the sinker's partner, who hauls up hand over hand until about 20 ft. in depth is reached. A rough windlass is then installed, and the sinking goes on to about 50 or 60 ft. At about 25 ft. the CO_2 content of the air becomes high and will not support the combustion of a candle, at 30 to 35 ft., according to the nature of the ground, the air becomes "hot," as the Chinese term it, and a temporary expedient is then effected by tying a big bunch of leafy branches to the end of the hoist rope and rapidly raising and lowering it. When a depth of about 40 ft. is reached, the air usually becomes really bad and fresh air is supplied by means of a portable forge-blower and an oil-coated calico tube of about 4 in. diameter. By this means the coolies will readily sink to 60 ft. provided the water is not too troublesome. The depths mentioned vary widely with the nature of the alluvium. The ascent and descent of the shaft are managed by means of staggered niches cut in the sides of the hole into which the hands and feet are placed.

The advantages of shaft testing over drilling are marked, inasmuch as the equipment is so simple and can easily be carried into distant and hardly accessible places. Then too, with the usual shaft-sinking crew, three or four holes can be worked simultaneously. This method opens up the ground for the personal observation of the sampler and allows a ready resampling when desired.

The sampling is carried out by making a vertical cut up the side of the shaft and allowing the contents to drop into the suspended bucket. This is usually done in 5-ft. sections, the bucket being tipped into a box measuring 8x8x7⅜ in., and whose capacity equals $^1/_{100}$ cu.yd. The contents of the box are well rammed down and leveled off, the material then being bagged and taken to the nearest creek for washing.

The quantity mentioned is a convenient unit amount to wash, as it completely fills one of the ore bags used in shipping wolfram concentrates and makes a convenient dishful for washing. The sample before bagging is weighed and its weight compared with that of a measured cube of similar ground cut out of some of the workings. The difference usually gives a fairly high conservative factor for valuation, but allowance must be made for the considerable percentage of large boulders not included in the sample. The product of the washing is taken to the laboratory where magnetite is removed by a magnet, the coarse material hand-picked clean and the fines rewashed. In weighing, a specially devised set of weights is used, the unit of which, weighing 70 grains, corresponds to 1 lb. per cu.yd. The weights extend from 3 grains (0.05 lb.) up to 7,000 grains (100 lb.). Thus the value of the washing concentrate is read off directly in pounds per cu.yd.

[1]A rupee is $0.32, an anna is $0.02, United States currency.

⁂

Southern Graphite Mining

Stimulated by the large war demand for graphite crucibles, during the last 18 months, graphite mining in the South has been unusually active. Even before the war, however, a number of Alabama concerns were successfully competing with the product imported from Ceylon and Madagascar.

The present centers of production are in Clay and Chilton Counties, Alabama. Near Ashland the graphitic schists occur in a number of parallel bands in a zone varying in width from one to two miles and known to extend for a length of at least 12 mi. These deposits are weathered to a depth of 50 to 65 ft. and mining is confined, so far, to the weathered material. Four milling plants are now in operation on this weathered graphite material, and two new plants are nearly completed.

A promising deposit of graphite is now being newly exploited at Burnet, Tex., by Los Angeles men, operating under the name of the Texas Graphite Co. The mine is 8 mi. from Burnet, the shipping point on the Houston & Texas Central R.R.

The deposit at this locality is in a band of schist 100 to 200 ft. wide traceable about 4,000 ft. Careful sampling of 1,400 ft. at the west end of the deposit resulted in 11,000 lb. of samples assaying 10.3% graphite. Though the flakes are smaller on the average than those of the Alabama deposits the preliminary examination indicates that the deposit will yield a fair proportion of flakes large enough for crucibles. A mill is now being built at the mine.—*U. S. Geol. Survey Press Bulletin,* July, 1916.

Details of Milling and Smelting

Interesting Belt-Cutting Kink*

In spite of all the belt kinks I have read and the number of times belt men have been cautioned to "cut the belt square" before lacing, here is a good one that insures straight running even though the cut is not made square. In fact, a straight-edge or steel square is not needed at all for jointing narrow belts. J. C. Conn is

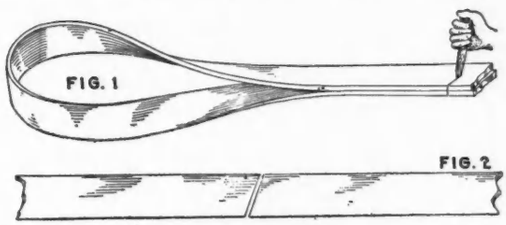


FIG. 1. SHOWS HOW THE BELT IS FOLDED, FIG. 2 HOW IT MATCHES

the discoverer of the method, and he has given me permission to give it to the belting world.

The sketches show the method plainly—Fig. 1 how the belt is laid for cutting and Fig. 2 how the ends match. Match the two ends, one on top of the other as shown, with both smooth sides either up or down and the sides perfectly even. Then cut both together along a straight line. If cut square, at 45 deg. or any other angle, the joint will be a perfect fit.

In case of double or triple belts, where both sides are smooth, place the "outside" of the belt either up or down. The belt must be twisted so that *the same side is on top* at the point of cutting. The reason is evident.

Differential Flotation Process

A recent British patent granted to Minerals Separation, Ltd., is designed to aid in the recovery of various sulphides by flotation. The invention comprises certain improvements in which ores are subjected to flotation separation with agitation in the presence of metallic copper or mercury, or of a compound of such metals, for obtaining preferential flotation and securing concentrates relatively rich in certain sulphides, such as zinc. In this invention an alkaline medium or a medium having a bichromate of an alkaline metal in solution is employed. The apparatus used in carrying out the process may be lined with copper or an alloy containing copper, or the apparatus itself may be constructed of this metal or alloy; or alternatively, the metal may be placed in the apparatus in any convenient form or may be introduced with the circuit or pulp in the form of finely-divided metal or compound.

Illustrating the application of the invention, an example is cited in which 250 lb. of a mixed zinc and lead sulphide ore assaying 31.5% zinc, 13.5% iron, and 7.8% lead, were subjected to flotation separation with agitation and aëration at a temperature of 140° F. with an amount of eucalyptus oil equivalent to ½ lb. per ton of ore, treated in a circuit water containing 0.1% of potassium bichromate, the dilution of the pulp being in about the proportion of 1:4. The separating vessel was built of wood and lined with copper. A float concentrate assaying 50% zinc, 7.2% iron, and 6.9% lead was obtained and a residue assaying 7.3% zinc, 20.9% iron, and 8.1% lead. In the second experiment, a mixed zinc, iron and lead sulphide ore, assaying 32% zinc, 15% iron, and 8% lead was subjected to flotation at about 130° F., with an amount of cresol equivalent to ½ lb. per ton of ore treated in circuit water containing in solution 0.1% of potassium bichromate, dilution again being 1:4. Carbonate of copper equivalent to 1% of the ore was added to and agitated with the mixture. Float concentrates assaying 53% zinc, 6% iron, and 4% lead were obtained, and a residue containing the bulk of the iron and lead sulphides. The patent bears No. 4,974.

*W. F. Schaphorst, in "Power," July 4, 1916.

Making Durable Flotation Froth

Since the efficiency of flotation is believed to largely depend upon the quantity, and especially upon the durability of the froth, the following process is designed to accomplish an increase in both for a given quantity of common frothing agent. Its success enables a reduction in the quantity of frothing agent which was previously necessary, a shortening of the duration of the process, and an increase of extraction in a given cell.

These results are attained by adding to the oil employed the necessary percentage of a resinate of an alkali such as soda, potash or lime. As a chemical equivalent of these others, ammonia may be combined with resin to form a resinate of ammonia.

The desired superior flotation oil is obtained by mixing together the following constituents: 50% petroleum, 15% pine oil, and 35% resinate of soda or resinate of ammonia. It is understood that rosin oil may be substituted for rosin in the above mixture, and the proportions may be varied at will to suit different ores. This process is the invention of Homer T. Yaryan, of Toledo, Ohio, granted patent No. 1,191,053 on July 11, 1916.

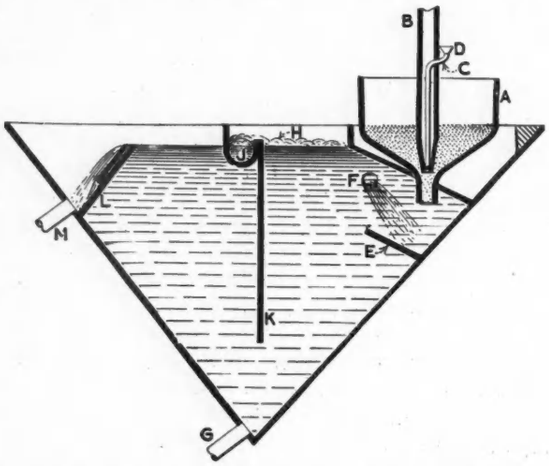
Ohrn Flotation Concentrator

With the object of eliminating mechanical agitation provided in the earlier patented apparatus, a steam jet acting as an injector both introduces the ore into the separation cell and provides the necessary aëration and agitation.

The crushed ore fed into the hopper *A*, shown in section in the accompanying diagram, comes in contact with the steam jet from pipe *B*, the combination of hopper and steam pipe acting as a steam injector. Within the steam pipe runs the small pipe *C* connected to the outside funnel *D* into which is allowed to drip the frothing agent, such as oleic acid. The steam jet sucks in the frothing agent and air, and, upon impinging on the ore particles

in the hopper, injects them within the separation cell beneath the surface of the water. The steam jet causes a thorough agitation of the mixture of frothing agent, air and ore pulp. The metalliferous particles become attached to the air bubbles, which are deflected toward the surface by the guide plate *E*.

As the mineral-coated bubbles rise, they meet jets of water from the spray pipe *F*, which help to remove any



SECTIONAL ELEVATION, OHRN CONCENTRATOR

gangue particles attached to them. On sinking to the bottom of the cell, the gangue particles are drawn off at spigot *G*. The metalliferous particles buoyed to the surface form a copious froth, which overflows the lip *H* into the launder *J*. The water containing the gangue slimes flows around the dividing partition *K* and up to the lip of the short partition *L*, thence through the outlet *M*. The inventor is G. E. Ohrn, of Stockholm, Sweden, granted Patent No. 1,187,772 on June 20, 1916, which is assigned to Minerals Separation, Ltd.

Improvements at Mt. Lyell

Foundations for the new converter plant at Mt. Lyell, Tasmania, are now being placed, but the delivery of the machinery has been delayed by difficulties due to the war, according to Chairman Bowes Kelly, who presided at the recent half-yearly meeting of the Mt. Lyell Mining and Railway Co. in London.

The flotation plant has been operating profitably for several months both on the Comstock ore and on low-grade ore of the North Lyell mine.

Perhaps the most interesting statement the chairman made in regard to metallurgical work was the reference to "the extraction of sulphur from pyrites by means of heat derived from coal and also from the electric current." "Some very pure sulphur," he said, "has already been made, practically on a working scale, but the economic features of the treatment still require further investigation."

If additional time be given in which to organize a company and raise the necessary capital, the directors intend to exercise their options on the Hercules, Tasmanian Copper and Primrose mines. Arrangements have been made with the Tasmanian government for 50,000 hp. from a hydro-electric development, and it is expected that the ores from the West Coast mines will be utilized for the production of electrolytic spelter.

Action of Crude Acetylene on Metals

In consequence of a communication from Wa. Ostwald regarding observations which contradicted the results of H. Reckleben and J. Scheiber and suggested the possibility of the formation of an acetylide by the action of acetylene on metallic copper, the latter repeated their experiments (*Chem Zeit.*, 1916, XL, 325; *Journ.* Soc. Chem. Ind., 1915, p. 214 and May 15, 1916).

Crude acetylene containing polymerization products, hydrogen sulphide, ammonia, etc., was passed over copper foil and the layer produced on the surface examined; it did not exhibit explosive properties on heating, and on boiling another sample with dilute hydrochloric acid, no acetylene could be detected after removal of the hydrogen sulphide from the gaseous products. Prolonged digestion with 15-20% hydrochloric acid resulted in the solution of the copper sulphide in the layer, and eventually the liberation of acetylene, which must therefore have been present in the combined state. The authors were unable to decide by analysis whether the nonexplosity of the product was due to the distribution of the cupro-acetylide in the sulphide, phosphide, oxide and other copper compounds, or to the presence of the more stable cupri-acetylide. It is considered remarkable that an acetylide should be produced in presence of hydrogen sulphide, as copper acetylides are readily converted into sulphide by an irreversible reaction with the liberation of acetylene.

Uranium in Tool Steel

The latest development in the tool-steel industry appears to be the application of uranium as an alloy in varying quantities, according to a note in *Iron Age*, Apr. 20, 1916. In the accompanying table are shown a number of comparative tests of tools made from uranium high-speed steel as compared with regular high-speed steel. The tools marked *U* are uranium-steel tools; those marked *B, C* and *D* are regular high-speed steels. The tests were made under the direction of the Standard Chemical Co., Pittsburgh, at the works of the Mesta Machine Co. and other large users of tool steel. All uranium tools were ½x1½ in., except No. 8-U, which was 1x2 in.

COMPARATIVE TESTS OF URANIUM AND OTHER HIGH-SPEED STEELS

Tool	Feed, In.	Speed, Ft. Per Min.	Depth of Cut, In.	Remarks
Cutting 0.50 per cent. carbon 12-in. shaft:				
No. 1-U	1/16	75	1/4	Went over once distance of 14 in. On second lap went 3 in.
B	1/16	75	1/4	Went distance of 4 in.
D	1/16	75	1/4	Went distance of 1 in.
Cutting 8-in. shaft 7 ft. 5 in. long:				
No. 1-U	1/16	51	1/4	Went over twice. Cut changed to 1/8 in. on second turn.
C	1/16	35	1/4	Did not go 1 in.
Cutting 6-in. shaft:				
No. 1-U	1/16	75	1/4	Ran 18 in.
No. 2-U	1/16	75	1/4	Ran 13 in. Speed increased to 90 ft. per min. and ran 11 in. Tool still good.
B	1/16	75	1/4	Ran 11 in.
Cutting 10-in. shaft:				
No. 4-U	1/16	60 to 65	1/4	Went 8 in.
No. 2-U	1/16	65	1/4	Went 4 in. Speed increased to 80 ft. per min. and went 3½ in.
No. 1-U	1/16	55	1/16	Wnet 16 in.
B	1/16	55	1/16	Went 2½ in.
No. 5-U	1/16	55	1/16	Went 15 in.
Cutting 12-in. shaft 22 ft. long:				
No. 8-U	1/16	45	1/8 to 1/4	Ran 87 in. Most of time the nose of the tool was right on scale.
Cutting 12-in. forging:				
No. 8-U	1/16 to 1/16	38	11/16	Went 127 in. Time 3 hr. Speed increased to 65 ft. per min. after tool had gone 105 in.
No. 8-U	1/16	60	1 1/16	Ran 12 in.

Sonoma Magnesite Mines, Calif.

By Lewis H. Eddy*

SYNOPSIS—The development of a magnesite property in which the transportation system was the greatest question. Quarrying and underground methods of mining both used. Ore treated in a calcining furnace and product shipped.

The property of the Sonoma Magnesite Co. is situated in the western part of Sonoma County, California, about 60 mi. in an air line northwest of San Francisco. The situation is about 12 mi. by wagon road north of Guerneville, a station on the Northwestern Pacific R.R. The nearest railroad point is Cazadero, 6 mi. south of the property. The company has built a narrow-gage tram road to connect with the Northwestern Pacific at a point called Magnesite, near Watson station. This railroad is 11 mi. long and extends to within 4 mi. of the plant.

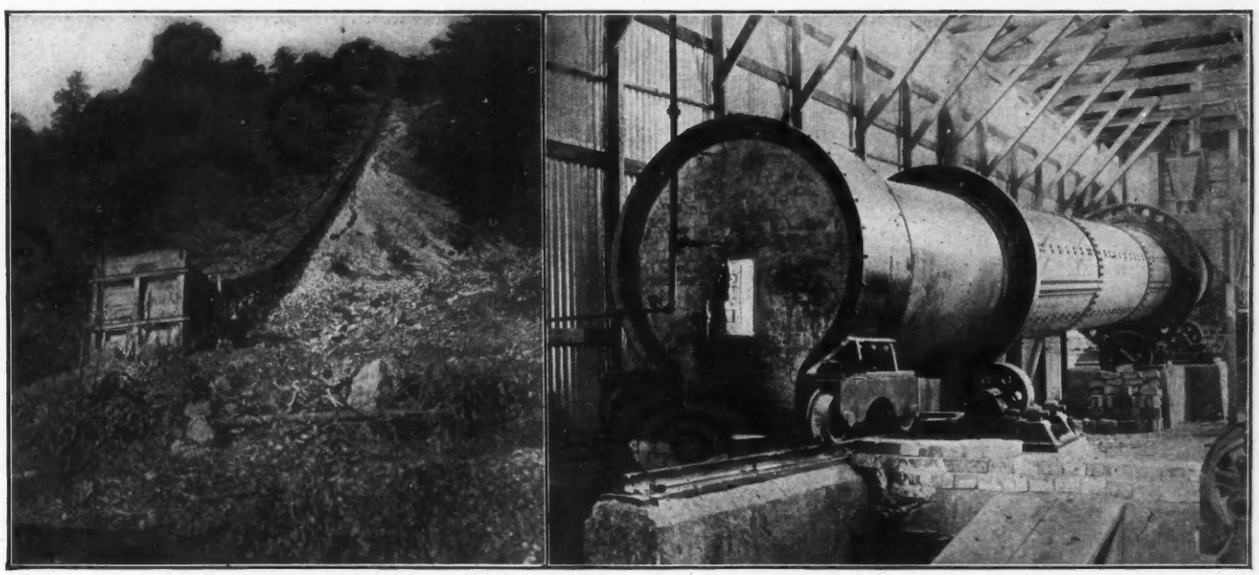
The property embraces 30 claims on Austin Creek, extending northwest and southeast for a distance of about 3 mi. The widest part of the holdings is 3,000 ft. The camp is situated in a deep gulch at an elevation of about 500 ft. above sea level, while the ledges and outcrops of magnesite extend for a height of 500 to 1,000 ft. above the floor of the gulch. The calcining furnace is at the southern end and narrowest part of the gulch. The depot, or loading station, of the narrow-gage tramway is about 4 mi. farther south in a broad flat. This station is called Magnesite.

The company has built a good wagon road at a fairly easy grade from Magnesite to the calcining plant and extended it through the camp to the upper mine workings of the property, a farther distance of about 2 mi.; thus making the total of 6 mi. of good wagon road. It is the purpose to extend the railroad from Magnesite along the bank of Austin Creek to the plant and thence to the upper mine workings, parallel to the wagon road.

*Associate editor, 3430 Peralta St., Oakland, Calif.

When this company took over the property about two years ago, the chief problem to be solved was that of transportation. It did not require a great deal of exploration to prove the existence of large deposits of magnesite, nor did the removal of ore offer any difficult problem. Whether removed by drifting and stoping or by quarrying, the ore is obtainable at a sufficiently low cost. The construction of a narrow-gage roadbed and track, a distance of 11 mi., through gulches and around and over hills, presented a more serious problem, which might have been better solved initially, but these errors are being cured by straightening the track and widening the road bed. The track is a 24-in. gage, and the rails are of 35-lb. steel. The equipment consists of a Davenport distillate locomotive and a Joshua Hendy gas-engine locomotive, 10 flat cars, and 6 oil-tank cars. The flat cars are 7 ft. long by 4 ft. wide and 5-ton capacity each, either sacked calcined product or loose crude ore. They are arranged for sideboards and end gates and also may be equipped with top and side covering should such covering be necessary during hauling in winter season. There are some heavy grades from Magnesite to the company's property, but the average possible grade is only about 3% up to the present site of the station at Magnesite. From that point for the next 6 mi. to the extreme northerly workings the grade can be reduced to about the same per cent. by following the bank of the creek. The hauling of the ore from the upper workings, a distance of 2 mi. to the calcining plant, has been done by animal teams; recently motor trucks were substituted. From the plant to Magnesite the haulage is by motor trucks, though it may be necessary to use animal teams during part of the winter for this leg of the haul.

There are three groups of magnesite outcrops in the company holdings, which occur in a large belt of serpentine that extends for a distance of 6 mi. in a northwesterly course from the south end of the company's



STEEL-LINED CHUTE AND CALCINING FURNACE FOR MAGNESITE

property. The ledges and veins have been prospected and sufficiently explored, by crosscuts, drifts and opencuts, to satisfy any magnesite miner of an unlimited supply of ore. The lower, or southern, end of the property has been developed by two adit tunnels. The lower one is 200 ft., drifting for a distance of 50 ft. on the outcrop of a vein 9 ft. wide; then run as a crosscut and encountering a small step-faulted vein of magnesite. The upper tunnel, which is supposed to cut the same formation, is a crosscut disclosing a vein of width varying from 6 in. to 12 ft. This magnesite is shown by analyses published by the State Mining Bureau, to be high-grade. The openings are at the site of the calcining plant. Since installing the plant, the company has made an opencut about 50 ft. wide and was taking out high-grade magnesite from what was the outcrop and heavy float from the 12-ft. ledge disclosed by the crosscut tunnel.

The upper, or northerly, croppings have been opened by quarrying at an elevation of nearly 1,000 ft. above the level of the camp and mill site, and a distance of 2 mi. from the lower workings. The quarrying operation supplies about 50 tons per 8-hr. day. The ore is sorted from the waste and dropped into a steel-lined chute a distance of about 200 ft. at an average pitch of 50° and dumped into loading bins at the lower end, situated on the wagon road. The wagons are automatically loaded and haul from 2 to 4 tons at a load. The chute is illustrated in Fig. 1. This open cut, or quarry, exposes some large veins and ledges, having serpentine for inclosing walls or associated with irregular serpentine formations.

The quarrying method, while it entails the expense of handling a large amount of waste, has been found to be the most economic method of extraction while the property was being developed, and provides for the prompt extraction of ore and haulage. The disclosures in the tunnels at the lower workings are sufficient to warrant the practice of drifting and stoping. At the upper workings, or quarry, a tunnel has been driven through the serpentine for 180 ft., which, if advanced 200 ft. more would tap the ledges at a vertical depth of about 250 ft. below the floor of the quarry.

Formerly the company contemplated the substitution of a bucket tramway for the chute and its extension to the point at which the new roadbed will terminate, about 40 ft. below the portal of the tunnel. But since then a full consideration of the advantages of underground mining instead of quarrying resulted in the determination of the company to advance the tunnel to tap the magnesite ledges and to install proper equipment of compressors and air drills. The ledges will be drifted on and the ore stoped and trammed out to the dumping station, which will be built at the terminus of the railroad extension. This will place the company in a position to carry on ore extraction in three shifts and provide a supply that will necessitate an increase in the milling plant. The tunnel will be driven by hand, which can be done at cost of about $4.50 per ft. Meanwhile quarrying will continue to supply sufficient ore for the present plant.

Ore Calcined and Shipped

All the ore hauled from the upper quarry and the ore extracted from the opening at the treatment plant is sorted. The selected crude is loaded on motor trucks for delivery to the company's cars at Magnesite, and the remainder is crushed in a Gates jaw-crusher, elevated to a feed hopper, where the dust is precipitated to the dust ovens at the bottom of the feed hopper and the ore delivered to an Allis-Chalmers calcining furnace. This furnace is 50 ft. long by 4½ ft. in diameter, having a rated capacity of 35 tons per 24-hr. day. The fuel used for calcining is distillate of California crude oil, commonly termed fuel oil, shipped in 50-gal. drums. It costs $1 per bbl. delivered at Magnesite. The calcined product passes from the kiln to a conveyor chute, built of firebrick on the floor of the mill, extending a distance of 10 ft. to the Meese & Gottfried endless-chain bucket-elevator system that carries it aloft and dumps it into the cooling bins. Fig. 2 shows a longitudinal view of the calcining furnace—the feed end at the extreme right background, the firing end in the left foreground. The cooling and storage bins are built by the Joshua Hendy Iron Works. The testing apparatus is composed of a small jaw crusher and a small grinder. Every 30 min. grab samples are taken and put through the crusher and grinder, the product going to the laboratory. The engine, pumps and shafting are Fairbanks-Morse type.

The plant is in the narrowest part of the gulch, the site being secured by cutting away the ledges of magnesite and their inclosing serpentine walls; in fact, the foundation of the building is a broad bed of magnesite and serpentine.

The calcining furnace was hauled in two pieces and the boiler in one piece by 60-mule teams from Guerneville over heavy grades. A part of this road even in summer, is about the worst example of mountain road that I have ever seen in the state. The hauling was done in the winter season, when the rains made the roadway almost impassable for empty wagons. All the material and machinery going into the construction of the plant was hauled over the same road, to the wonderment of even the management itself. But the demand for magnesite warranted the cost of difficult hauling.

The extraction and shipment of magnesite has been in active progress only about a year, and the little narrow-gage railroad was not completed until Apr. 20, 1916. Prior to that the crude ore and calcined product were hauled to the Northwestern Pacific station at Guerneville by motor truck and animal team.

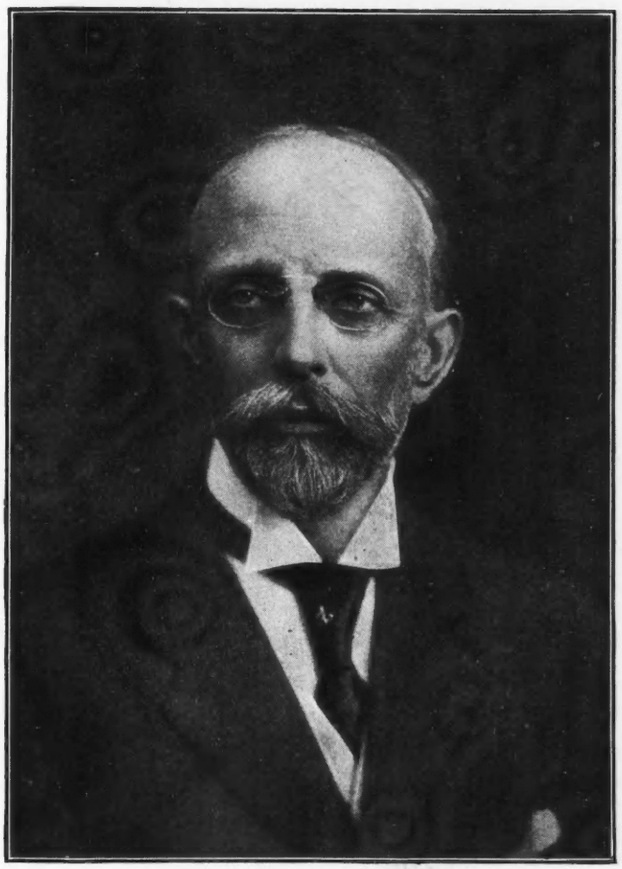
War Affects German Iron Mines

An announcement of the United States Department of Commerce reports that since the outbreak of the war the demand for iron products has been so great that the industry in Brunswick district, Germany, has been extremely prosperous. One of the greatest difficulties with which the manufacturer has had to contend is the scarcity of manganese, which is mostly imported. The ore used by the Ilseder Hütte, an iron foundry in this consular district near the City of Peine, is so rich in manganese that it is now shipped to other foundries in Germany as a substitute for the imported mineral. The demand has been so great that the greater part of the village of Adenstedt with its church has had to be demolished. The Ilseder company has just declared a dividend of 33⅓% which, the annual report says, was principally earned by the sale of this ore, as the sale of the manufactured products of the company has not been more than two-thirds of that in time of peace.

Charles Kirchhoff

Charles Kirchhoff died at his summer residence, North Asbury Park, N. J., July 22, aged 63 years. He was born in San Francisco, but was educated in New York and passed most of his earlier years there. About 1869 he went to Germany and studied there, graduating from the Bergakademie at Clausthal as mining engineer and metallurgist. Returning to this country in 1874, he obtained a position as assayer and later as chemist and assistant superintendent of the Delaware Lead Works, a refining and desilverizing plant in Philadelphia.

At the time of the Centennial Exposition in Philadelphia in 1876, he secured a position as technical correspondent for several English and German journals, and his letters attracted much attention. This experience seems to have determined him to make technical journalism his future career, and after the close of the exposition he became connected with the staff of the *Metallurgical Review*. A year or so later he joined the staff of the *Iron Age*, but left it in 1880 to become managing editor of the *Engineering and Mining Journal*. In 1884 he returned to the *Iron Age* as associate editor and in 1888 was made editor-in-chief, a position which he held for 21 years. He was also for a large part of that time vice-president of the David Williams Publishing Co., publisher of the paper.



CHARLES KIRCHHOFF

Under his able management the *Iron Age* prospered exceedingly and came to be recognized as the leading organ of the iron and steel trades. He secured the services of many able contributors both at home and abroad and placed the paper on a high plane. He became intimately acquainted with the leading men of the iron and steel trades and was generally recognized as a keen and accurate observer and a wise counsellor on both technical and commercial points. A year or two before the organization of the Steel Corporation, Andrew Carnegie, whose intimate friend he was, urged him to join in the activities of the Carnegie Steel Co., which was then fast becoming the leader and chief factor in the steel industry; but Mr. Kirchhoff declined, preferring to continue the editorial work in which he had been so successful and in which he was completely absorbed.

While always the guiding head and director of his paper, Mr. Kirchhoff did not seek to absorb the entire credit of the work. He raised up around him a body of assistants who ably seconded his work, and when he made up his mind finally to retire, in 1909, they were able to take up and continue the management on the same high plane to which he had adjusted it. After retiring he traveled in Europe for a time and later found employment in travel, in writing occasionally for his paper—in which he retained a financial interest—and in the affairs of the various societies with which he was connected and in whose proceedings he was much interested. It should be mentioned that at an earlier date, in addition to the work on *Iron Age* he had for several years acted as agent for the United States Geological Survey in collecting statistics of metal production.

Mr. Kirchhoff was a member of the American Institute of Mining Engineers for many years and took active part in its proceedings. He was chosen president of the Institute in 1898-99 and again served as president in 1911-12. He was a member of the Iron and Steel Institute and of the American Society of Mechanical Engineers, also of the Iron and Steel Institute of Great Britain and the Verein Deutscher Eisenhüttenleute. He was a member of the Century and the Engineers' clubs.

United States Steel Corporation reports for the quarter ended June 30 as below, the net earnings being the surplus over all working expenses and ordinary repairs and renewals:

	1915	1916
April	$7,286,409	$25,423,676
May	9,320,576	27,554,899
June	11,343,070	28,147,473
Net earnings for quarter	$27,950,055	$81,126,048
Depreciation and sinking funds		$9,745,826
Interest, etc., on U. S. Steel bonds		5,673,962
Total charges		$15,419,788
Surplus for the quarter		$65,706,260
Dividends declared		17,741,725
Undivided surplus		$47,964,535

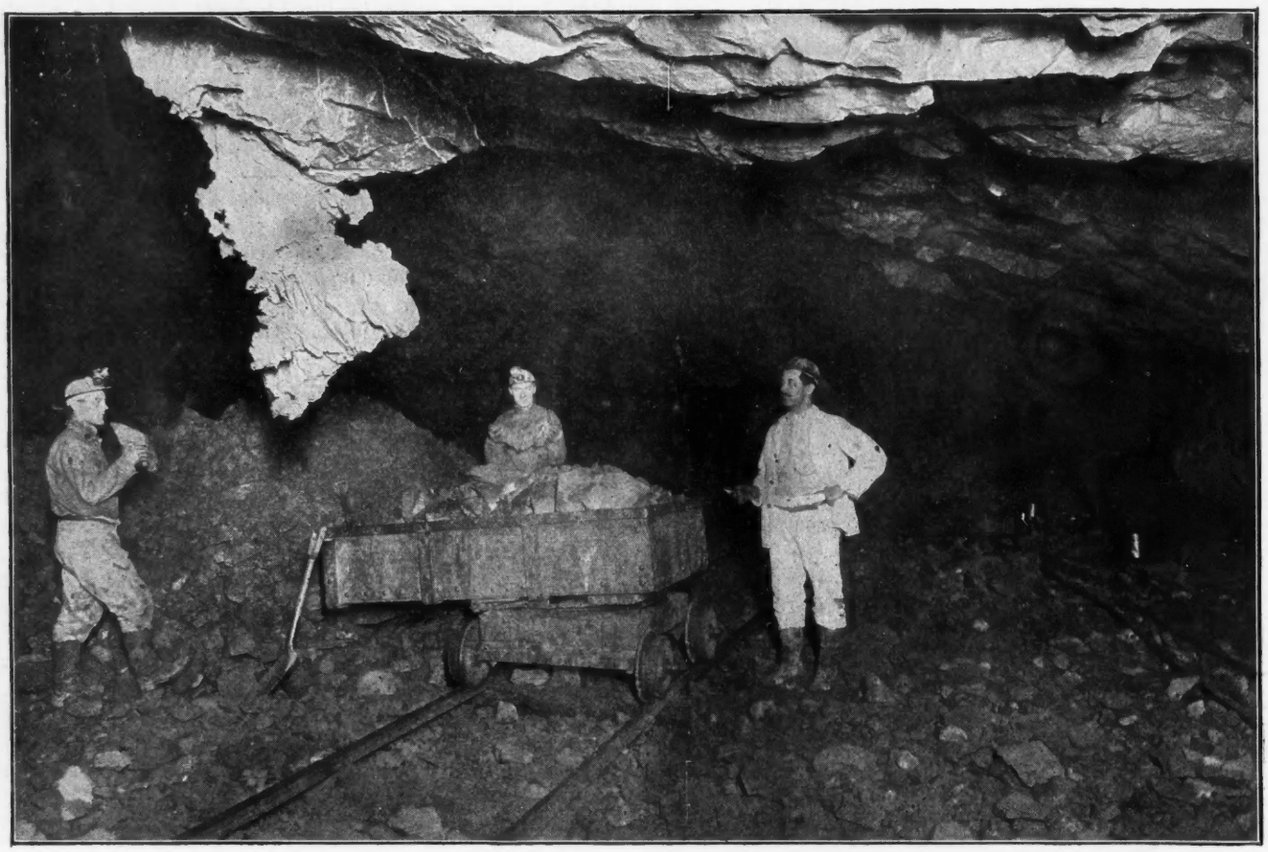
The dividends declared were the regular 1¾% on the preferred stock and 2¼%—being 1¼% quarterly and 1% extra—on the common stock. No statement is made of any special appropriations from surplus. The net earnings for the half-year ended June 30, 1916, were $141,839,672, being $101,431,808 more than in the first half of 1915.

President Farrell issues the following statement: "During the past quarter the plants and properties of the Steel Corporation were operated at their maximum capacity. Both production and earnings exceeded those for any previous quarter.

"The several subsidiary companies have many extensions and improvements under way, calling for the expenditure of a very large sum of money. These improvements are mainly for the purpose of diversifying products and increasing the economic efficiency of the properties.

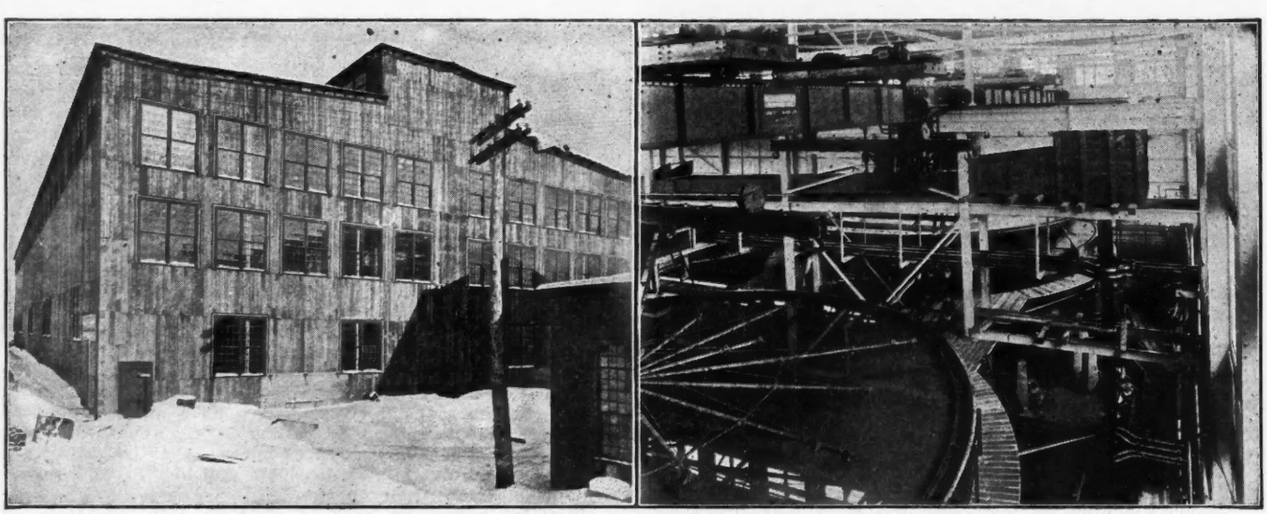
"Unfilled orders on hand at June 30, 1916, amounted to 9,640,458 tons, which will occupy the mills for several months. New business is coming in at a satisfactory rate, many contracts being entered for delivery of materials throughout 1917."

Photographs from the Field



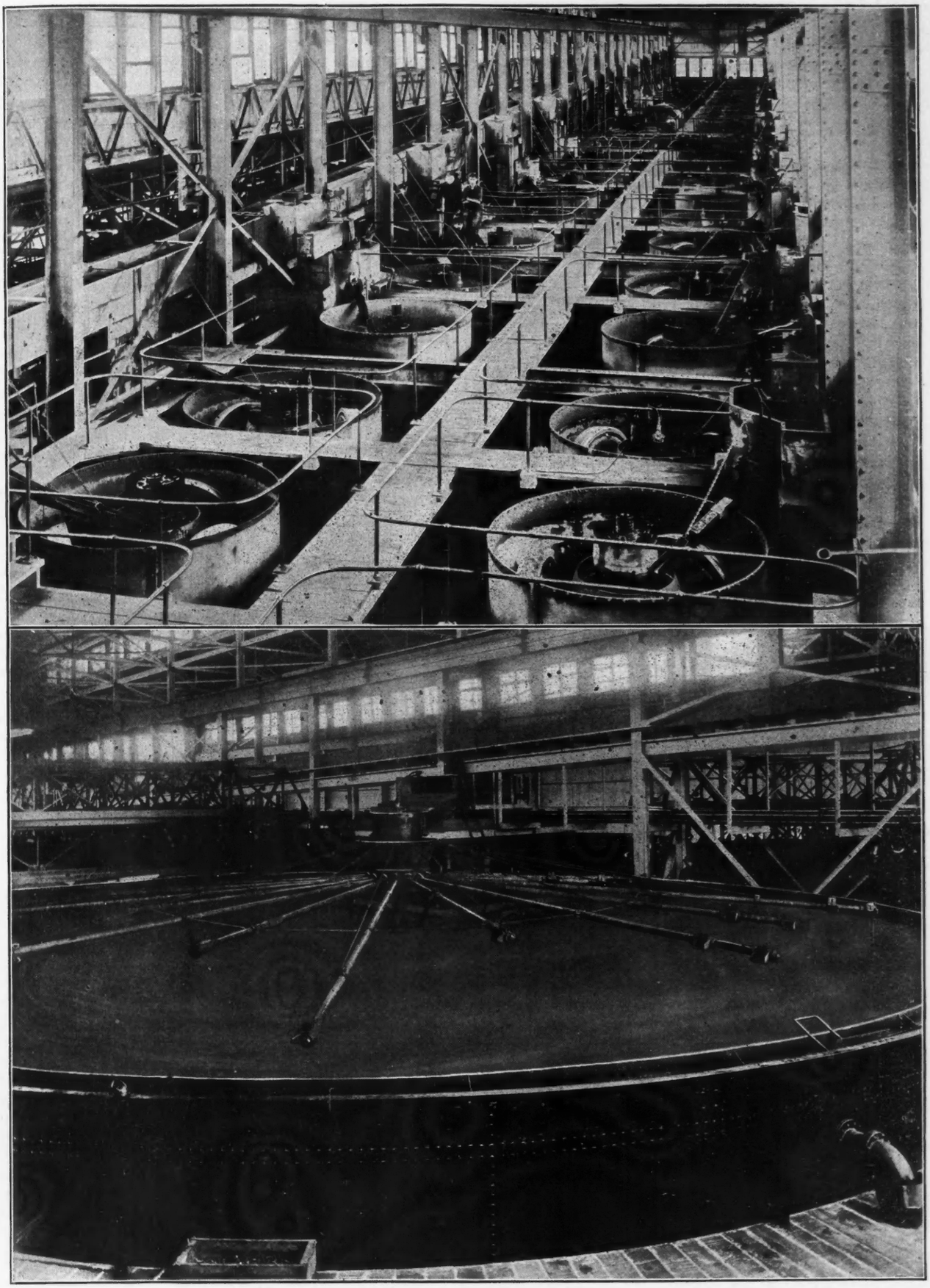
MASS COPPER IN THE CHAMPION MINE, PAINESDALE, MICH.

Occurrences of masses of native copper in the Lake Superior district are sometives of great size. This particular mass extended over 100 ft. above the portion shown in this view. In another of the Copper Range Consolidated properties, the Trimountain mine, there was an occurrence of mass copper extending from the third to the 22nd level



CALUMET & HECLA'S NEW LEACHING PLANT AT LAKE LINDEN, MICH.

This plant, near the shore of Torch Lake, will treat by the ammonia-leaching method the tailings now being recovered from the lake bottom by a suction dredge. The initial plant has eight 1,000-ton leaching tanks and will have a capacity of about 2,000 tons daily, the treatment cycle requiring about four days



TWO INTERIOR VIEWS IN THE NEW CALUMET & HECLA LEACHING PLANT

Correspondence and Discussion

Bolivian Mining Data

In the *South Pacific Mail* of Apr. 27, 1916, appears an article on Bolivia copied from the *Bulletin* of the Pan-American Union. Within the last two years a number of articles on Bolivia and the west-coast republics have been published (some of them in the *Journal*), the majority of which have undoubtedly been written by men with but a scant acquaintance with their subject. Their bad work may be forgiven, as perhaps they did their best.

But from such a publication as the *Bulletin* one expects correct data. In the article mentioned, the Antiquera (Antequera) mine is referred to as a rich tin mine. This must be over-cocktail information from Antofagasta. The Antequera mine is perhaps the most dismal failure in Bolivia, as many a Chilian investor can testify.

Berenguela, in the province of Cochabamba, is said to have an exceptionally high grade of ore. As a matter of fact it is well known to have an exceptionally low grade of ore. Moreover, Berenguela is a mountain, on which are located four to six tin-mining companies, all of little importance. I doubt if the total production amounts to 40 tons of *barilla*. The Berenguela company, the biggest concern, is the most consistent producer.

We have yet to learn in these parts, that the Monte Blanco mines are a great success. As the Santa Fé lode is said, in the *Bulletin,* to have an average width of 6 to 9 ft. (1,000 ft. of outcrop) and 12% pure cassiterite, it ought to have been made a success. Such values are not to be found, and the statement has probably been copied from some authority still more unreliable than the *Bulletin*.

Again, it is stated that "in the country of the Aymara no such objects (bronze) are ever found, yet it is here that the known tin deposits of the present time are located." I read this to mean that there are no known (or few) tin deposits in the country of the Quechua race. An exactly opposite statement would be nearer the truth. Chorolque, Tasna and Chocaya Mountains, embracing some of the best tin mines, are in the country of the Quechua. Chorolque (a mountain) is described as one of the four mining districts of Bolivia. The mountain is the center of the mining activity of the Aramayo Co., operating also on Chocaya and Tasna. From Chocaya the output is now probably greater than from Chorolque, the chief producers being the Oploca Co., Aramayo (Chocaya section), and smaller concerns. The whole district can more correctly be described as the Southern Potosi. At present the mines of Bolivia can best be divided into three groups: First in importance, those of Oruro (with the town of Oruro as center) and including the Berenguela mines; second, those of the department of Potosi; and last, and not yet of much importance, the mines near the City of La Paz. There are other errors in this article, but enough have been noted, as may be seen from the corrections noted here, to show that the *Bulletin* is not a reliable authority on Bolivia. J. H. IVEY.

Antofagasta, Chile, June 16, 1916.

Gas Explosion in Metal Mines

An accident occurred recently at the Peters mine of the Puruni Development Co., Ltd., Demerara, British Guiana, which may be of interest and may also serve to call attention to an unusual form of danger, against which it will be wise to take precautions in opening up old mines.

The property had been closed down for six years when we began to dewater the shaft about Mar. 1, 1916. After the workings were pumped to the 300-ft. level, another engineer and I waded in through about 4 ft. of water to make an examination. About 350 ft. from the shaft a stope 140 ft. long had been opened and timbered with square sets on the level. Above the timber the stope was filled with waste to within 15 ft. of the back, with the exception of four cribbed chutes and manways. A connection to the level above was at the time sealed by mud and water, making the open part of the stope an excellent trap for gas.

There was no evidence of gas or foul air on the level, but an attempt to climb one of the manways was almost immediately followed by a violent explosion, accompanied by blue flames that continued to burn for some time. The water on the level was fortunately deep enough to afford a temporary refuge and was probably the means of preventing a fatal accident, as the heat was intense and all parts, even those momentarily exposed, were severely burned. The gas must have been generated by the decomposition of the mine timbers, as neither the quartz-vein matter nor the hornblende-schist country rock could well have been responsible for it. Local hardwoods, greenheart and mora, were used in timbering. The volume of the gas that ignited was about 40,000 cu.ft. This experience suggests the advisability of using a safety lamp or something of the kind under similar conditions.

E. V. NEELANDS.

Demerara, British Guiana, June 15, 1916.

Drill Steel Consumption

Having had occasion to investigate the consumption of drill steel at our company's mine and found it surprisingly high, I have been trying to secure data from other mines for comparison. Much to my surprise I found, on looking through a stack of company reports, that only an insignificant number of companies apparently paid any attention to the cost of drill steel. Beyond the bare fact that it cost from $0.002 to $0.004 per ton stoped at some of the largest mines where the stoping tonnage per drill-shift was as high as 35, and from $0.011 to $0.021 per ton where the tonnage was considerably less, the investigation netted nothing. Apparently this cost item is one commonly relegated to the catchall caption such as "miscellaneous costs," "general expense," or "sundries," or if mentioned at all, most aggravatingly lumped under cost of "drill steel and sharpening," a most unfortunate condition.

The most valuable information so far accumulated was furnished by the Colonial Steel Co. of Pittsburgh as follows:

"One of the large zinc-mining companies states that the loss of steel due to wear, breakage and resharpening is 0.02 lb. per ton of ore broken, or ⅔ lb. per ton of concentrates. Loss for each resharpening operation is 0.07 lb. steel. This data refers entirely to 1¼-in. round hollow steel."

In the hope that this will attract the attention of others interested in the subject, I am forwarding the item to you for publication.

I am bound to admit that the steel consumption at our mine is very much greater than at the rate of 40 to 50 tons stoped per lb. of steel. And if other managers of comparatively small mines will look into the facts, I believe they will discover a similar condition at their own properties. It is probably a common failing with most of us to take it for granted that the blacksmith knows all about steel and its sharpening and that is one item the manager need not worry his head about. As a matter of fact, I believe investigation will show that most blacksmiths waste more steel than is necessary. Others through a mistaken zeal for quantity of work to please the boss, burn a lot of steel on the one hand, and do such a poor job of tempering, on the other hand, that the drill footage per shift is materially reduced.

I know one or two mine managers who never set foot in their shops more than once or twice a month and then only to promote good feeling by handing out the smokes. This good-feeling promotion is commendable, but it would be more so if, when once established, the manager would take the time to learn a few facts about steel consumption in the shop and then figure a way to help the blacksmith save the company considerable money by reducing consumption and increasing footage. DRILL STEEL.

New York, July 20, 1916.

Propeller Slimes Agitator

I have been deeply interested in the descriptions of the propeller slimes agitator as published in the *Journal* of May 6, and July 15, 1916. My attention has been attracted to this device because I have been operating slimes agitators since the institution of slimes treatment by agitation, beginning with the original system of putting an air pipe into a slimes tank and moving it around by manual labor. I have seen the development of the mechanical agitator from its simplest forms to the air agitator and the patented forms, such as the Trent, Patterson, Pachuca, Parral, Hendryx, Dorr, and a lot of others. The tendency from the beginning has been to secure as efficient agitation as is possible with least possible expense. The system as installed at the plant of the Hedley Gold Mining Co. appears to me to partake of the qualities of the Hendryx agitator. While nobody denies that the Hendryx is a good machine, and this new agitator may be as good, both of them giving efficient agitation and good results so far as extraction is concerned, it still seems to me that they must consume more power than most operators care to put into slimes agitation at the present time. Most of the modern agitators will give good results in the same way, but the object to be attained is to secure the agitation with the least possible expense. It appears that some of the new forms of tanks, such as the Pachuca or the Dorr agitators, must be able to deliver good results, so far as agitation and extraction are concerned, together with lower costs than can be expected with a propeller device. It has generally been considered that the propeller system entails higher costs due to its greater power consumption. I should be deeply interested in knowing more about the results obtained at the Hedley mill with the Devereux propeller, since if a device of this kind can be operated at a cost as low as some other types of slimes-agitating machines, it would be of value for me to know of it.

New York, July 20, 1916. HENRY A. MARVIN.

Drilling and Analysis of Copper Ores

I have read with interest A. J. Sale's able article on "Drilling and Analysis of Copper Ores," in the *Journal* of July 8, 1916. Mr. Sale's attitude as to the reliability of assayers reminds me of the time-worn story of the blind man at the circus who, having laid hold of the tail of the elephant, declared the animal to be shaped like a rope.

His statement in the article that "any manager who trusts his copper assaying to any one man, without any kind of a check, is courting commercial suicide" appears to me to be a rather far-reaching assertion. I believe most engineers will agree with me that the chance of receiving the grossly inaccurate returns cited in his article are remote—so remote in fact as not to be worthy of taking into account as a probable source of error in drill-hole or any other samples. I also believe that most men who have had any considerable experience with sampling and laboratory work will agree that the chances of error, after the sample has been delivered to the assayer, are slight.

The errors mentioned in Mr. Sale's contribution—"one drill hole where over a hundred feet of nearly 2% ore was reported as 0.5%, and in another hole where the same grade of material was reported as 0.1%"—appears to me to be due, possibly, to the employment of the "ocular" or "backdoor" method of assaying rather than to the extreme insolubility of the "refractory" chalcopyrite and other complex sulphides contained in the sample.

Grants Pass., Ore., July 13, 1916. E. R. CROUCH.

Engineering Students Number Over Thirty Thousand

The appended tabulated figures on students in the engineering schools of the United States were presented at the recent annual meeting of the Society for the Promotion of Engineering Education, through the coöperation of the United States Bureau of Education and the society's Committee on Statistics. A variety of interesting comparisons are possible, such as the great increase in chemical engineers, the decrease in civil and mining, and the slump and recovery in number of mechanical engineers.

STUDENTS IN THE UNITED STATES

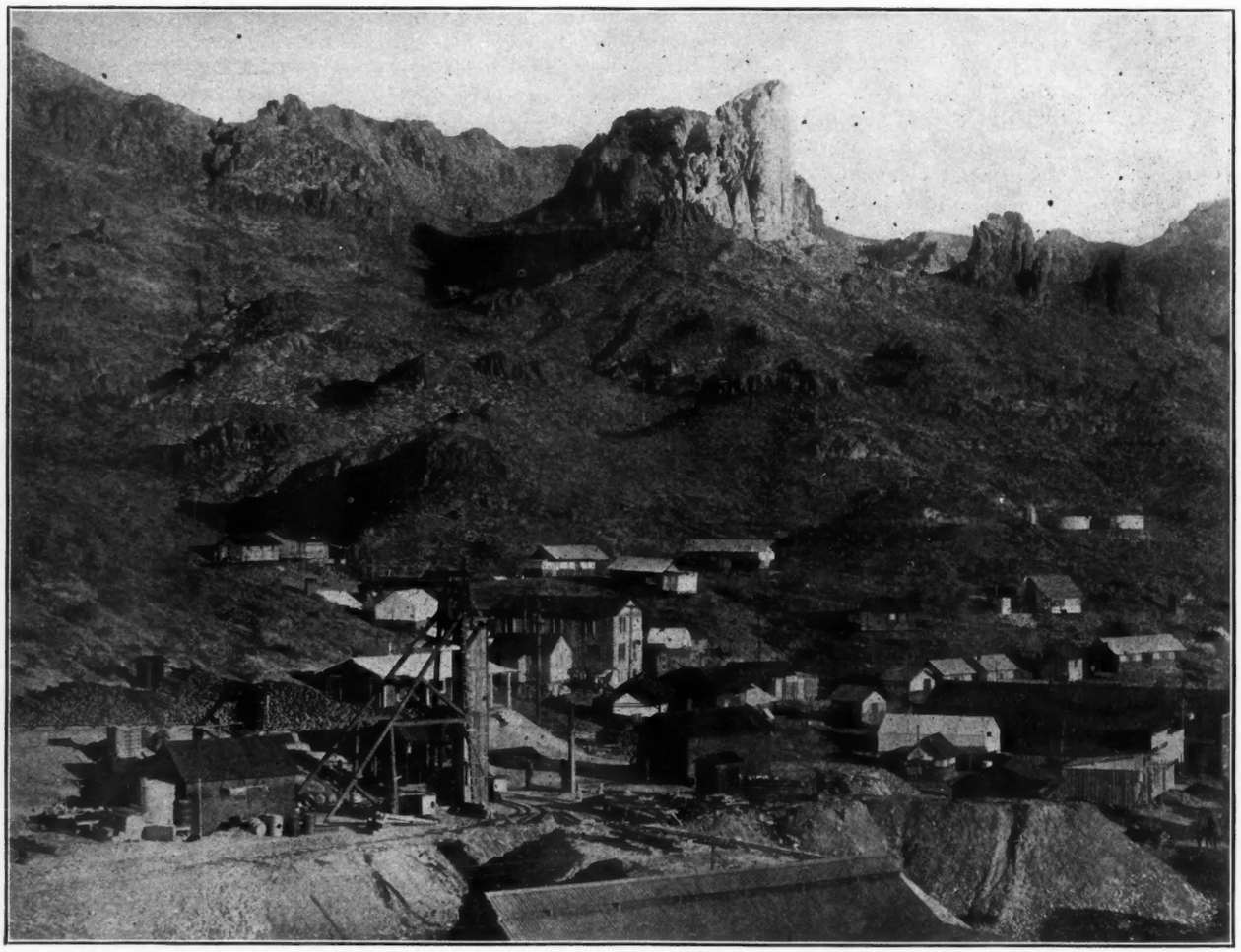
Engineering Branch	1906	1911	1915
General	2,501	5,591	6,059
Chemical	1,234	1,452	2,383
Civil	7,962	8,934	7,182
Electrical	5,696	6,128	6,637
Mechanical	7,426	7,052	7,751
Mining	2,826	2,337	1,922
Other	82	....	958
Total	27,727	31,499	32,843

United Eastern Mine, Oatman, Ariz.

By J. A. Burgess*

SYNOPSIS—Brief account of the development of the United Eastern mine, the discovery of which resulted in the present activity at Oatman.

The discovery and the opening of a large body of high-grade gold ore on the property of the United Eastern Mining Co. at Oatman, Ariz., was accomplished with a directness and speed that has seldom been equalled. The company was incorporated in November, 1913. In March, 1914, shaft sinking was started by means of a hand windlass. After sinking to a depth of 40 ft., work was stopped temporarily, until July of the same year. At this time a headframe was erected and in September a gasoline hoist was set up. In October, 1914, the shaft intersected the vein near the 200-ft. level. The vein was small and weak, but offered encouragement to the prospectors. Samples averaged from nothing up to $8.78. About a month later the 300-ft. level was reached and a crosscut encountered the vein 40 ft. from the shaft. At this point the vein was also small, but a width of 1 ft. assayed from $14 to $27, a selected sample assaying $193. By March, 1915, a crosscut was driven through the vein on the 465-ft. level, where a width of 25 ft. of ore averaging $22.93 was exposed. Since that time the vein has been opened by drifts and crosscuts on the 565- and 667-ft. levels, with the result that about 200,000 tons of ore, assaying higher than $20 per ton in gold and having a gross value of approximately five million dollars, has been opened sufficiently for sampling and estimating. In places the ore has a width of 40 ft. No work has been done below the 667-ft. level, but the orebody maintains its strength and grade at that depth. The vein consists of calcite irregularly banded with quartz, the valuable metal content being practically all in gold. The country rock is andesite.



UNITED EASTERN SHAFT, THE STRIKE IN WHICH STARTED THE OATMAN EXCITEMENT

An all-sliming cyanide mill of 200 tons daily capacity is now being built on the property and a new working shaft is being sunk. The crushing department of the mill will have a capacity of 400 tons and the cyanide department will have a capacity of 200 tons. This arrangement will permit of doubling the capacity of the mill readily, whenever it may be required. It is expected that the mill will be completed the latter part of this year.

*General superintendent, United Eastern Mining Co., Oatman, Ariz.

The discovery of the United Eastern mine reads like a romance. In March, 1913, J. L. McIver, a miner and a man of keen observation, came into the Gold Road-Tom Reed district looking for a "poor man's opening" in mining. He found two of these that suited him; one was a lease on the old Moss mine, and the other was an option on the group of claims now included in the United Eastern property. The principal merit of the latter was its proximity to the oreshoots of the Tom Reed mine. After securing these options, McIver sent to Bisbee for his partner, George W. Long, and these two proceeded to work on their lease, and at the same time tried to raise funds for developing the United Eastern property. With absolute faith in the enterprise they did what work they could by themselves, and even went to work for wages in the adjacent Tom Reed mine to raise additional funds. Their observation in this mine confirmed their faith in their optioned property, and they approached several captalists for financial assistance.

On June 27, 1914, W. K. Ridenour, of Oatman, secured a small block of United Eastern stock at 25c., and had sufficient confidence in the property to recommend and sell United Eastern shares to his friends at 25c. From these sales, together with those of Long & McIver, there was raised, up to December, 1914, approximately $13,000, which was applied to the development of the property. All of these people to whom the stock was sold have reaped great profit on their investment. In December, 1914, they were successful in interesting Messrs. Frank A. Keith, Seeley W. Mudd and Philip Wiseman, of Los Angeles, and through them secured the funds that enabled them to carry their enterprise to its present state of success.

Italy, A Field for American Mine Supplies

By Charles Will Wright*

As a mining country Italy has not attracted much attention in America. Its metal production is comparatively small and comes mostly from the lead and zinc mines in Sardinia, although the mercury and pyrite mines in Tuscany and the iron mines on the island of Elba add largely to the annual metal output. Although these Italian mines are among the most ancient, it is only during recent years that developments on a sufficient scale to make them important producers have been initiated, and the large tonnages of ore at present available and the extensive fields for further exploration, particularly in Sardinia, make the outlook promising.

The total amount of supplies consumed at the mines in Sardinia alone equals $2,500,000 annually. Previous to 1915 a large percentage of the mine supplies were imported from Germany and names such as Koppel on the mine trucks, Krupp on the ball mills and Flottman on the rock drills are the most noticeable. Without these importations from Germany and because of the present high freights from England and America, the prices of many of the mine supplies in Italy have risen 100%, and more in certain instances. The supplies that are largely imported consist of drill steel, piping, rails, rock drills and compressors for underground work; steel cars, car wheels, hoists, wire rope, aërial ropeways and ore sacks for transport; and belting, shafting, clutches, screens, steel balls, crusher plates, roll shells, etc., for the concentrating mills. As to the steam-engine plants, Diesel and gas engines and electrical equipments, most of the mines use those of Italian manufacture. Milling machinery, such as jigs, screens, and table, is constructed at the mines or by the local foundries.

There are a number of steel plants in Italy, and a few of them manufacture such mine supplies as cars, rails, piping, steel balls and roll shells, but since their output does not meet the demand and that for drill steel, wire rope, belting, screening, etc., the mines are practically dependent upon imports. For this reason many of the necessary supplies are now becoming scarce and high prices are being paid for those of inferior quality. A few examples of present prices are as follows: Drill steel solid and hollow, 2 lire and 3 lire per kg. (18 and 25c. per lb.); construction steel, rails, etc., 0.60 to 1 lire per kg. (5 to 9c. per lb.). For dynamite, oil and coal the prices have more than doubled. It is probable that as the difficulty of obtaining these supplies increases still higher prices will be paid and certain of the necessary articles may not be obtainable. Such is the present condition of the market.

The Italian field, though now small, is a growing one and worth the attention of the American manufacturer who desires to export his products, and the present year is the time to consider how to introduce them into Italy before the German manufacturers corral the business, as they certainly will do after the war, wherever they find an opening.

The writer's experience has been confined to the importation of small shipments of mine and mill machinery from the United States to Sardinia, and because of the difficulties encountered he finds that certain changes are necessary before American exporters can hope to have any success in selling their products in Italy or in other Latin countries. This problem of promoting trade relations with the Latin countries presents many difficulties—serious difficulties, although they may not at first seem so—which the American manufacturer must recognize in order successfully to compete in the future with German manufacturers, who have mastered the situation.

They must first realize that foreign purchasers cannot be bothered with our system of selling supplies by the foot, pound and gallon, which denominations often mean little to him, while quotations given in the metric system, which he knows thoroughly, are more acceptable. A prominent mine manager recently showed me a quotation per foot and per pound for drill steel from an English firm, given in English currency against cash payment by some London bank on presentation of shipping documents. He shrugged his shoulders and said *"Come si fa?"* (What can one do?). It would take him some time to figure out the quantity and cost per kilogram or meter in his own currency, and as to the amount to add for transport and duty he knew nothing. The result is that he sends his order to some agent in Italy, who gives him quotations in the metric system and in Italian currency, including transport and duty to Italy and often to the railway station nearest his mine and against payment on or soon after receipt of goods. This agent naturally adds from 20 to 60% to the price as his commission.

Giving quotations in the metric system and currency of the country from which the request comes is not enough. The American exporter must obtain the freight

*Mining engineer, Ingurtosu, Sardinia.

rate and quote for deliveries at one of the principal ports in the country to which the shipment is to be made, and, still better, he should indicate the amount of duty to be paid at the port of entry in that country. A table of duty rates can be obtained from any Italian consulate or from Ulrico Hoelpi, publisher, Milan, Italy.

The Italian mine manager, and it would probably be the same in Spain or any other Latin country, usually has an exaggerated idea of freight rates and duty on imports, and this fear often prevents him from sending orders to foreign firms.

To get this trade it would be well for the American manufacturer to have his catalogs or descriptions of the articles he has to offer translated in Italian, French or Spanish as the case may require. A list of the mining companies that would probably become purchasers should also be obtained, catalogs sent then and a local agency established if possible. The turning over the sale agency for a district to a foreign agent is often risky, as he may hinder rather than promote business, especially if he is not situated in the mining district. The foreign agent does not always realize the importance of advertising or the necessity of following up inquiries in order to find business, and it is therefore advisable for the American manufacturer to do his own advertising by correspondence. By using caution in selecting local agents in the foreign mining districts and by providing such agents with prices and samples of articles or descriptive matter properly translated, it will be possible gradually to build up a substantial foreign trade.

The usual method of payment for supplies from the Italian and German firms is one-third of the amount with the order, one-third at the time of the delivery of the goods and the balance three months after delivery. Payments are usually made through some bank such as the Credito Italiano, which is represented in New York by the Guarantee Trust Co., and the standing of the mining companies may be ascertained through them.

The Italian mining companies are generally of high standing, both financially and morally, and they must be so considered. If they are to trust the American manufacturer to ship the quantity and quality of goods ordered, they must in turn be trusted to pay for them, as they are accustomed to do with Italian and German firms. To demand full payment for goods against presentation of shipping documents to some New York bank discourages foreign business.

Tin Mining in the Federated Malay States

Tin production in the Federated Malay States in 1915 showed a small decrease, according to the mine warden's report. The total output for two years past was, in gross tons:

	1914	1915	Changes
Perak	28,557	27,776	D. 781
Selangor	15,103	13,938	D. 1,165
Negri-Sembilan	1,697	1,244	D. 453
Pahang	3,685	3,808	I. 123
Total	49,042	46,766	D. 2,276

At the close of the year there were 164,457 men employed in the mines, of whom 205 were Europeans, 2,372 Malays, 5,313 Indians and 156,414 Chinese. The conditions of employment show that 85,589 miners worked under lease or tribute, 45,070 under contract, 32,131 were paid wages and 1,667 were independent miners or prospectors, holding individual licenses.

There was an increase in 1915 in machinery used in the mines, the chief instances being the completion of the hydraulic plant of the Gopeng Consolidated Mining Co. and the rebuilding of the Perak electric plant. Ten dredges were at work at the close of 1915, seven of them having been installed during the year. Another one is under construction for use at the Bentong Mine in Pahang.

Chinese not only form the great majority of the workers, but predominate in the management, 72% of the output being from mines controlled by Chinese.

Sicilian Sulphur Production

The sulphur situation in Sicily remains strong. Export demand for England, France, Australia, Russia and Sweden has been very active; on the other hand, production has decreased, owing to the fact that the mines are suffering from increased cost of coal, wood, oil and explosives, and to a certain extent from dearth of labor as well, the younger men having been called to arms. The export figures, according to Ferd. Baller & Co., from Jan. 1, 1915, to Dec. 31, 1915, are as follows:

EXPORTS OF SICILIAN SULPHUR

	Metric Tons		Metric Tons
Sicily	7,685	Sweden-Norway	24,781
Italy	108,916	Turkey (Eu ope)	.....
Austria	70	United States and Canada	2,054
Belgium	.....	Central and South America	5,517
Denmark	51	Egypt	825
France	96,156	Algiers	6,540
Germany	391	Turkey (Asia)	.....
Greece	19,857	India (English)	5,010
England-Malta	36,156	Australia	330
Holland	1,163	Other countries	11,035
Portugal	12,784	South Africa	9,474
Russia	2,791		
Spain	8,220		359,806
Stocks on hand Dec. 31, 1915			323,391

The production as published for the fiscal year of the Consorzio stands as follows: From Aug. 1, 1914, to July 31, 1915, 335,000 tons (of 1,000 kg.). During the same period 1915 to 1916, it is estimated that the production will show a decrease of about 10%, say 300,000 tons altogether, and that from Aug. 1, 1916, to July 31, 1917, it will not exceed 275,000 tons. In consequence the prices have advanced considerably, and for a short time the Consorzio offered small parcels only, then withdrew altogether from the selling side. Now they have decided to sell one month about the quantity produced in the preceding month and not to sell for future delivery. They intend also to give the preference to Italian consumers and to those of the allied countries. The Consorzio will expire July 31, 1918, and it is expected that up to that date the stock available will be greatly reduced.

A Mine Lessor's Liability Concerning Materials

By A. L. H. Street*

On foreclosure of a lien against mining property for materials and labor furnished a lessee of the property in its development, personal judgment may be rendered against the lessee, but not against the lessor, according to the holding of the Oregon Supreme Court in the case of Haines Commercial Co. vs. Grabill, 152 Pacific Reporter, 877.

*Attorney at law, 829 Security Building, Minneapolis, Minn.

Editorials

The Zinc Situation Abroad

The report of the Zinc Corporation for its last year and the address of Mr. Govett, the managing director, at the stockholders' meeting in June throw some light on the zinc situation abroad. It should be borne in mind that the tension in spelter arose from the isolation of Germany and Belgium—where the bulk of the accumulated stock at the middle of 1914 was held—and the sudden closing of the outlet for the mines of Broken Hill, Australia. There was plenty of ore, the supply being adequate as it was previous to the war, but there was no place to smelt it. This put a premium upon smelting capacity, the price for spelter rose to figures unheard of previously, and this was an invitation to enterprising persons to build new smelteries as fast as they could—which was done, especially in the United States.

We can see now that the British authorities failed completely to grasp the basic facts of the situation, although the zinc companies did. The companies were hampered, however, by the government's onerous—nay, impossible conditions—with respect to new plant and the long course through the courts that the companies had to pursue before they could obtain legal release from their ore contracts with the German concerns. Mr. Govett reviewed all this and made numerous statements respecting which the muddle-headed would do well to reflect. Among others were the following:

"To recapitulate—the original contracts were necessarily with Germany, as there were no English buyers. After the outbreak of the war we could not sell—first, because there were no immediate buyers anywhere, and secondly, because we could make no new long contract, on account of the risk of being left short of material in the event of the German contract reviving at the end of the war."

The first of these statements is identical with what the *Journal* has been telling the world from the beginning. Out of all the wild talk about a German conspiracy—which was made largely for political effect—the simple fact is that the Australian ore went to German houses for the reason that there were no other buyers. In obtaining release from its contract with Aron Hirsch & Sohn, the Zinc Corporation did not get through the maze of the British courts until the Board of Trade declared void contracts contrary to the national interest, so after all it was not the courts that settled the matter. The release of the Zinc Corporation was not an unalloyed blessing, for Aron Hirsch & Sohn was owing it £84,000 for concentrates delivered before the war and the Zinc Corporation has not yet been successful in attaching any realizable assets of the firm.

In attempting to dispose of its production during the war, however, the Zinc Corporation was not idle. Theodore Hoover visited the United States in October, 1914, and upon his return to England made recommendations, which were not adopted for one reason or another—partly Governmental obtuseness—although of course Mr. Govett does not say so or imply it. Among other things the sale of some of the companies' ore to American smelters was contemplated. Later, when negotiations were renewed, it was found that Australian concentrates were being offered on much cheaper terms by other Broken Hill companies. "That was the trouble," said Mr. Govett, "the ruinous competition of the other companies."

In the meanwhile progress has been made in several directions. A large tonnage of Australian ore has come to the United States. A good deal has gone to Japan, where the smelters have greatly increased their capacity. British smelters have also been increasing their capacity—belated but nevertheless increasing—and now comes the important statement by the Zinc Corporation that it has made a contract for a sale of 100,000 to 150,000 tons of concentrates to supply the requirements of British smelters. The electric zinc smelters of Scandinavia have also been increasing their production. In short, the production of zinc has been expanding in all parts of the world, although nowhere else in so spectacular a manner as in the United States.

But the Australian producers are looking further ahead. In their lead business they allied themselves some time ago as the Broken Hill Associated Smelters, taking over the plant of the Broken Hill Proprietary at Port Pirie, which company has now become the largest single producer of lead of the world. About the same companies lately formed the Zinc Producers Association, which is going to handle the combined zinc output. The Zinc Corporation has gone into this, with reservations that may permit it to unite with the Burma Corporation in certain contingencies. The plans of the association, which has been developed to a large extent through the visit to Great Britain by Mr. Hughes, the Australian Premier, assisted by W. S. Robinson, the managing director of the Broken Hill Associated Smelters, include the ideas of erecting smelteries in England and Australia, steps to insure the exclusion of German spelter after the war and preferential treatment of the Empire's products, allowing a fair share of the raw materials to France and Belgium. Careful consideration of trade relations with France and Belgium, especially the latter, where zinc smelting has for centuries been an important industry, was necessary.

What of lead and spelter after the war? "Will there be an enormous demand for lead and zinc to replace waste and in rebuilding," asks Mr. Govett, "or will the world be in ruins financially as well as actually? I do not see my way, but this is clear; since the high prices there has been an enormous increase in capacity for output of spelter in America. The war is likely to end with large stocks on hand, and it may be that the price of spelter will be very low indeed, and there may be no profit from this source until the price rises, unless we can sell our concentrates to English smelters, as far as they can take them, under a tariff or a bounty, which

is the fence that the government has got to jump. If I may hazard a guess, it is that after the war the price of lead is likely to continue high, while if the government will jump the fence the price of spelter will be above the living wage for the Australian producers." It is owing to such views that the Australian producers are asking the Imperial Government to grant a bounty which will maintain for them a spelter price of £23 per ton, or 5c. per lb., which in their opinion is the point of "living wage."

The Steel Corporation

The statement of the United States Steel Corporation for the June quarter was expected to show a large gain over the preceding quarter and over last year, but it has proved to be even better than was anticipated. Not only are the net earnings larger than those reported in any preceding quarter, but the surplus over all charges and dividends on the preferred stock was equal to 11½% on the common stock. Only a fraction of this was divided, the common stock receiving an extra dividend of 1%, making its total 2¼% for the quarter. The undivided surplus was $47,964,535, of which a large part will doubtless be used in the extensive improvements now being made at Duluth, Gary, Ojibway and elsewhere, though no formal appropriations for those purposes are announced. Possibly some of it may go into the reserve fund to equalize dividends, of which Chairman Gary has talked at different times, but this is not at all certain.

The net earnings for the quarter, reaching a total of $81,126,048, or about three times those of the corresponding quarter in 1915, reflect the joint influences of extremely active business, and of increasing prices. Both domestic and foreign orders were heavy and the gradual advance of prices begun early in the year was continued. Apparently it has very nearly reached its limit, however, since the recent effect has been to limit domestic sales and to check consumption. The familiar danger signals are thus displayed and doubtless will be effective so far as any further price raising is concerned. The foreign trade remains strong and does not seem to be affected.

The Steel Corporation has not directly entered into the manufacture of war munitions. It has taken large contracts for rails and other materials for export. It has, however, supplied much steel to manufacturers of munitions, and to that extent has profited largely by the war demand. The amount of this business cannot be determined without further information, but it must have been very large. An important point in the statement is that existing orders and contracts are not only sufficient to provide for active employment of the mills through the balance of the current year, but also that many of the contracts provide for business running well into 1917. This seems some security against any abrupt collapse of business, especially as successful efforts have been made through the past two years to systematize and improve the rather loose system of contracting for steel and iron which formerly prevailed.

The Steel Corporation for several years has furnished about 45 to 50% of the finished steel output of this country. Its quarterly reports, therefore, are looked upon as fair indications of the general course of the steel trade. In the present case the indications are good. The large volume of business done and the profit realized, point to a year of real prosperity in the trade. It is possible that there may be some recession in prices, but it is not at all likely that such a recession will go below a point where fair profits may be realized by the steel maker; and it would be more than compensated by increased business.

Cargo of the "Deutschland"

There has been a good deal of conjecture respecting the cargo that the submarine "Deutschland" is to take back to Germany. Ideas finally focused on a cargo of nickel and rubber, which was embarrassing to the United States. Great Britain lifted her embargo on nickel, rubber and other commodities required by us upon our assurance that they would not be permitted to leak out to Germany. The nickel question, in particular, has been raised repeatedly by Canadian politicians seeking political capital against the Government. If the "Deutschland" should carry out nickel, fate would have unexpectedly played into their hands and they may be relied upon to make most of it. The International Nickel Co. has been very careful in supervising the destination of its nickel and does not believe that any of its product can be on the "Deutschland." It is pointed out that there is a considerable production of nickel in the United States from domestic byproducts.

If the New York *Telegram* is to be relied upon, however, there is not going to be any controversy, for the packages marked "nickel" that are stowed in the hold of the "Deutschland" are now rumored to contain not nickel, but $4,000,000 in gold. But "whether this is true or not," remarks the *Telegram,* "it is known that 3,000 bottles of beer are a part of the cargo, designed for alleviating German thirst." This looks much like carrying coals to Newcastle.

The Proposed Tax on Copper

At a hearing before a subcommittee of the Senate last week, on the matter of the proposed tax on copper, a new point against it was offered; namely, that such a tax as is contemplated would be unconstitutional, being distinctly class legislation. That objection might be met by extending the tax to all metals, but then what a howl there would be from the zinc- and lead-producing districts! That alone would be sufficient to defeat the whole project.

Another objection, which was not brought out in Washington, so far as we know, but which is a good one, is that the tax falling on refiners would have to be paid by them on copper derived from foreign raw material as well as domestic.

American copper refiners have during the last 10 years built up an immense import business, drawing copper to their works from all parts of the world—South America, Australia, Japan, Africa and Europe—in competition with the refiners situated elsewhere. The diversion of crude copper from Great Britain and Germany to New York has been one of the recent romances of business. The taxation of their production will be a handicap to them in their competition with the rest of the world.

BY THE WAY

No one appreciates the possibilities of engineering less than the engineering papers. Look at the following advertisement from a nontechnical contemporary:

Solution producing unlimited power from power without cost, and motor combining both principles, requires manufacturing facilities. N-25, Times.

⁂

"Two Constant Readers" who write from McGill, Nev., but do not give their names, inquire "what is the lowest price reached by English sovereigns during the last two years, in New York, and could they be bought in the open market at the price quoted? By 'sovereign' is meant the gold coin minted by Great Britain." The principal firm of coin and bullion brokers in New York informs us that it has bought English sovereigns on several occasions at $4.85 per sovereign during the last two years, and considers that to be about as low a price as they have reached during that period.

⁂

Perhaps one of the neatest compliments ever paid any type of drilling machine is contained in the remark of a certain Finnish miner in one of the mines of the Crystal Falls, Mich., iron-mining district. A few years ago, just after the light, rotating, hammer drills had been introduced in this district, this miner, who had been given one to use, happened to go to the warehouse on some errand or other. After his wants were supplied, the warehouse clerk asked him, "John, how do you like your new drill machine?" To which he replied, in characteristic dialect, "O, dat's ma-seen no good. He is go 'Br-r-r-r-r' five minutes—I s'ovel all day."

⁂

Messrs. Samuel Montagu & Co. write from London under date of June 29: "The attitude of neutral countries toward gold imports is curious and interesting. It is reported that Holland wished to purchase lumber from Sweden, and as Sweden would not take any gold, such purchase was found to be impracticable, as the two countries possessed more gold than they needed or cared to have. After prolonged negotiations, Sweden agreed to take a certain amount of gold, as a matter of grace, at a price 3% lower than the ruling rate. The transaction was then completed and Holland received its lumber. Thus the extraordinary circumstance occurred of gold being accepted by a state institution only at a heavy discount compared with the currency of that country."

⁂

Mining south of the Mason and Dixon line makes many gray hairs for the engineer, but occasionally gives a laugh. The store at one mine carried two brands of tobacco—smoking and chawin'—about the only difference being that one came as a plug and the other in a paper package. One day an old mountaineer came into camp and purchased some tobacco. A few days later he was back again and tried the other brand. He loaded his pipe carefully, took a few whiffs and spat violently. He took another draw and a look of unutterable disgust crept over his face. He was game, however, and kept on puffing for a few minutes. Then he rose to his feet, knocked out his pipe, heaved the package halfway across a nearby river and remarked: "I'd just as soon hol' ma maouth wide open and let the sun shine into hit as smoke them thar tobacco."

⁂

The proclivity of the Latin races (particularly Mexican) toward the use of firearms for the settlement of all disputes is shown by the following story related in a recent issue of the New York *Times:*

Refugees recently arrived in Havana from Mexico City tell the story of the killing of Gen. Benjamin Hill, military commander of the Federal district, in a fight with Jean Tardan, a Frenchman, proprietor of a famous hat store in the Mexican capital. They say Hill entered the store with his staff to buy a fancy sombrero as a present to Carranza. The proprietor himself waited on him. Hill selected a hat and inquired the price. Tardan answered: "Seven dollars and a half American, 15 pesos Mexican silver, 750 pesos uncounterfeitable bills, and 3,000 pesos Mexican counterfeitable bills." Hill became incensed at the last price, as he has always maintained that Carranza money was as good as American. He drew his revolver and began shooting. Tardan shot also, mortally wounding Hill. The staff then drew revolvers, shot Tardan until lifeless and then killed every clerk in the establishment. The staff then sacked the store.

This would make it appear that shopping at present in Mexico has a certain amount of spice to it.

⁂

"Some time ago it was my not pleasant duty to sit on a coroner's jury over an unfortunate who had fallen some two hundred feet in a chute," wrote a young mining engineer from a Western mining district. "The verdict we rendered was not satisfactory to some of the mine officials; they claimed it was irrelevant and unfair. I give below the sole reason for the objectionable phrase. We were assembled in a small room in which was stored a quantity of candles; the floor was littered with paper and other rubbish. But paper and candles were not the only combustibles in the place; there were explosives as well. An open fuse box full of capped primers, ready for use, was lying on a full box of blasting caps. The superintendent came in and seated himself on the candle boxes, just above the fuse box full of primers. He was smoking a cigar, and he seemed not to see the naked caps. I moved as far as I could get away from the cigar and watched it. Some time during the taking of the testimony, it dawned on me that a live ash about an inch long was due to part company with the cigar at any minute. There were the shining caps directly beneath it. Now I was not familiar with the company's safety-first methods and practices, and besides, I am a timid man. Then, too, it stood to reason that an attempt to call attention to the situation at that moment would have been quite as dangerous as any other procedure and much more embarrassing. I said nothing and sat still. As per schedule, the ash fell. I closed my eyes. A minute or an hour later, however, I was sufficiently calmed to realize there was a spirited argument being indulged in by the state mine inspector and the head of the company's safety-first department as to whether the gathering was a coroner's jury or a safety-first meeting. The inspector claimed it might appropriately be both. When the question was finally decided, the spectators filed out and the jury was instructed to give a verdict. I got hold of the paper and wrote (and I could not have agreed to anything less lenient): 'It is the opinion of the jury that the company should have taken more precaution to safeguard the life of the employee.' Perhaps it was unfair; I never heard the testimony."

PERSONALS

E. C. Petro, late at Hayden, Ariz., is now in Denver.

F. H. Jenks has gone from Oatman, Ariz., to Albuquerque, N. M.

C. H. Coberly has gone from Rowena, Colo., to National, Nevada.

W. A. Gilles is now at San Pedro, N. M. He was recently at Ophir, Utah.

Frank W. Reeves has gone from San Bernardino, Calif., to Bartlesville, Okla.

J. A. McDonald, recently at Berkeley, Calif., has gone to Montana and is now at Anaconda.

N. L. Warford, recently at Phillipsburg, N. J., has gone to Montana and is now at Anaconda.

G. Miller has gone from Cobalt, Ont., to the Reward Mine at Manzanar, Inyo County, California.

Lloyd T. Buell, recently at Benson Mines, N. Y., is now with the Ore Trading Co., Ltd., Santiago, Chile.

Joseph H. Hill has gone from Rapid City, S. D., to Ray, Ariz., where he is with the Ray Consolidated mine.

Glenn L. Allen is now metallurgist for the Shattuck-Arizona Copper Co. and may be addressed at Bisbee, Ariz.

Dr. J. A. Dresser of the Canadian Geological Survey will make an examination of the Rice Lake district of Manitoba.

G. A. Morrison, recently in Chicago, is now with the American Star Antimony Co., at Gillham, Sevier County, Ark.

Dr. August Foerste, geologist, of the University of Ohio, is in Ottawa conducting researches at the Canadian Geological Survey and examining rock formations in the neighborhood.

A. M. Bilsky and a party of Montreal capitalists have returned from an inspection of the Atlas gold prospect in the West Shining Tree district of Ontario with spectacular samples of ore.

Charles A. Moffitt, for some time past manager of the plant of the Gulf States Steel Co. at Gadsden, Ala., has been chosen vice-president and general manager of all the plants of the company.

G. G. S. Lindsey, of Toronto, formerly president of the Canadian Mining Institute, who has been in China for a year and a half, during part of which time he was engaged in drafting a mining code for that country, has returned to Canada.

Arthur W. Stevens has just returned to Piedmont, Calif., from a three-months' examination trip, during which time he visited Ouray and other camps in Colorado, the Bullion Coalition mine in Utah, Hamilton and other places in Nevada, all in the interests of New York and Philadelphia parties.

R. L. Daugherty has been appointed professor of hydraulic engineering at Rensselaer Polytechnic Institute, Troy, N. Y. He has for the past six years been assistant professor of hydraulics in Sibley College, Cornell University. Professor Daugherty is the author of "Hydraulic Turbines," "Centrifugal Pumps" and "Hydraulics."

OBITUARY

Sir William Ramsay died at his residence in England July 24, aged 64 years. He was eminent as a chemist and writer. Born in Glasgow, Scotland, he was professor of chemistry in the University of London for 26 years. He was an honorary member of many foreign societies and a winner of the Nobel prize. His discovery of argon, a hitherto unknown element in the air, and his experiments in the transmutation of elements were his most noted achievements.

Thomas Macdonald Patterson died at Denver, Colo., July 23, aged 77 years. Born in Ireland he came to this country when a boy, living first in Indiana and then in Colorado. He was prominent for many years in politics and as owner and editor of the "Rocky Mountain News" and the "Denver Times." He was twice United States Senator from Colorado. His chief connection with mining was at the time of the Leadville boom, when he, with C. S. Thomas, acquired valuable mining property in that district.

Philip Diedesheimer died in San Francisco, July 21, aged 84 years. He was for many years prominent as a mining engineer, and was the designer of the square set system of mine timbering first used on the Comstock and since adopted in many well-known mines. He was engaged in mining on the Comstock and in California for many years and was widely known in California. He was alternately successful and unsuccessful and died a poor man, although he owned claims which he hoped would make him rich.

Fred. T. Williams died at Salt Lake City, Utah, July 14, aged 40 years. He was born in Cleveland, Ohio, and graduated from the Colorado School of Mines. After working for five years at Victor, Colo., he went to Utah in 1906 and was for some time engineer for the Daly West Mining Co. In 1911 he formed the Federal Leasing Co., of which he was president and general manager. This concern leased mining claims from the Daly West and other companies and was most successful. He leaves a widow and two children.

W. R. Patterson died at Chicago, July 19, aged 62 years. He was distinguished as an electrician, and was connected with the Western Electric Co. for 32 years, retiring to become a consulting engineer. He was the inventor of many electrical devices. Mr. Patterson was born at Effingham, N. H., where he received his early education. In 1876 he was graduated from Dartmouth College. He was for 39 years a resident of Chicago, where he was a member of the University Congregational Church, the Union League Club, the American Society of Civil Engineers, and the Western Society of Electrical Engineers. He leaves his widow, two daughters and a son.

William Teague, a widely-known British Columbia pioneer, who had lived in that province about 58 years, died at Seattle, Wash., recently. He was a native of St. Day, Cornwall, England, and was 81 years of age at the time of his death. He went to British Columbia in the "Oregon," the first steamer to make the call at Victoria from San Francisco. Proceeding thence to Hope, on Fraser River, he worked at placer-gold mining on Cornish bar. In 1873 he was appointed Provincial Government Agent at Yale, where he remained twelve years. After leaving the government service, he resumed mining, but later retired from active work.

John Francis Campion died at Denver, Colo., July 17, aged 67 years. Born in Prince Edward Island he went to California with his parents when a boy. In 1868 he engaged in mining in California, and spent 10 years at White Pine in that state and at Pioche and Eureka in Nevada. In 1879 he went to Leadville and from that time on was prominent in the history of the famous camp. He was interested in several of the large mines of the Leadville basin and made a careful study of the district which lead him to invest on Breece Hill. With several others he formed the Ibex Mining Co., the management of which he retained until his death. From his Leadville properties he accumulated a fortune. He moved to Denver a number of years ago, and was largely interested there in banking and other enterprises. He leaves a widow and four children.

SOCIETIES

American Institute of Mining Engineers—In connection with the Arizona meeting at Douglas, Bisbee and Globe, Sept. 19-22, arrangements have been made for an excursion in which Eastern members may join. It will leave New York, Sept. 14, going by way of Chicago, will visit various mines and plants in Arizona, the Grand Cañon, the Apache Trail and other points of interest and will reach New York Sept. 28 on the return trip. The arrangements for the train are in charge of W. V. Lifsey, 1216 Broadway, New York.

INDUSTRIAL NEWS

The Sullivan Machinery Co., of 122 So. Michigan Ave., Chicago, and Salisbury House, London, England, has established an agency in Holland with Messrs. Petrie & Co. Heerengracht, 141-145, Amsterdam, as its special representatives. Messrs. Petrie & Co. will sell the Sullivan air compressors, rock drills, hammer drills, diamond core drills, quarrying and coal-mining machinery in the Netherlands. This new arrangement replaces the Sullivan Machinery Co. agency previously at the Hague.

Hirsch Electric Mine Lamp Co., of Philadelphia, has recently manufactured a new "Hirsch" portable electric lamp outfit of high candlepower, suitable for shaft digging and mine work. The lamps are made in two sizes, 6 volts with three cells 20 to 25 cp., weighing 10 lb. complete and 10 volts with 5 large cells 35 to 40 cp. and weighs 26 lb.

Editorial Correspondence

SAN FRANCISCO—July 19

Bullion Receipts at the San Francisco Mint for the month of June, according to the report of Superintendent Shanahan, were: Gold, 201,019.319 fine oz., valued at $4,155,438.26; silver, 63,856.98 oz., valued at $40,339.

Proposed Option of the Lincoln Consolidated at Sutter Creek was the interesting feature of the week's news from Amador County. A purchase option has been taken provisionally by James Hoatson, of Calumet, Mich., for $205,000, this price to be payable in four semiannual payments of $41,000 each, in addition to a payment of $41,000 upon execution of the option. The purchaser is not obligated to operate the property, but in case of operation all the yield over $3 per ton is to be applied on the purchase price. Meeting of stockholders to be held Aug. 7 to ratify the option and consider the question of disposition of funds of the company. There are 606,555 shares outstanding. The indebtedness of the company, which is $2,000, will be paid at once.

Production of Oil in California in June increased about 6,000 bbl. a day as compared with May, the average daily yield being 255,451 bbl., or a total of 7,663,510 bbl. for the month. The total crude stock on hand at June 30 was 51,199,918 bbl., a decrease during the last six months of 5,947,133 bbl. The total production of all fields for the first half of 1916 amounted to 43,709,756 bbl. For that period the several fields produced as follows: Midway-Sunset, 18,962,650 bbl.; Whittier-Fullerton, 6,861,701; Coalinga, 6,321,449; Kern River, 4,244,275; Lost Hills-Belridge, 2,217,947; Lompoc and Santa Maria, 2,068,720; McKittrick, 1,516,127; Los Angeles and Salt Lake, 888,264; Ventura and Newhall, 586,748; Summerland, 28,225; Watsonville, 13,650 bbl.

The Explosion of an Oxygen Tank at Keswick, in the oxy-acetylene department of the Mountain Copper Co. machine shops on July 16, which finally resulted in four deaths, was the third within four days in California, these three explosions causing a total of 7 deaths and 4 serious injuries. The explosions were in three different counties; the first was at the Hercules Powder Co. plant in Contra Costa, and the second one at San Francisco. The Metal Weld Co., of San Francisco, which furnished the oxygen tank used at Keswick, sent a telegram of warning to postpone the use of it as a similar tank had exploded on July 14 in the works of the California Artistic Metal and Iron Co. in San Francisco, when two men were killed. The telegram, however, arrived too late. Karl L. Brackett, manager of the Metal Weld Co., is investigating the cause and an investigation is also being made by the state mine inspector.

DENVER—July 18

The Ward District in Boulder County is experiencing a decided improvement in its mining activities. Formerly there were numerous profitably operated mines near this town, but for a number of years little ore has been mined. It was known years ago that there were good showings of tungsten in the lodes, but the ferberite always accompanied sulphides and there was no market for tungsten ores that carried sulphur. The same veins also carried gold and silver and these were the metals sought in working the mines. Since the more recent demand for tungsten, no objection has been raised against small amounts of sulphur in an ore and a number of the old mines have been reopened while prospectors have discovered many new tungsten-bearing veins. Among the older mines that are being given new attention are the Star, managed by George P. Sale; the Newmarket, owned by Burnhart & Sharks; the Queen, owned by a Mr. Walter, of Denver; the Nelson; the B. & M., owned by T. B. Burbridge and superintended by S. A. Stafford; the Knight; and the Porto Rico. The Humboldt mill, erected a year ago, is being run on gold-tungsten ores, from which it makes good concentrates of the separate metals. The mill embodies stamp crushing, amalgamation and concentration on tables.

The Lake Mine, at the top of the divide between Clear Creek and Gilpin Counties, is one of the original 50x3,000-ft. claims of the State. Right now, it possesses special interest from the fact that ore is being mined in large amounts at a depth of 2,400 ft. from the surface, operations being conducted through the Big Five tunnel, whose portal is at Idaho Springs. The vein is a strong one, traceable for six miles, and is opened up in the Frontenac and Aduddell mines in which—as at the Lake—the surface workings produced ore high in lead and zinc, whereas at a medium depth, these metals are replaced by high-grade gold ore carrying grey copper. The Big Five tunnel cuts the Lake vein at a distance of about 8,300 ft. from its portal. Here a strong shoot pitching to the west from the Frontenac is drifted on at a depth of about 2,300 ft.; this shoot is already proved for 600 ft. along the level and has been stoped to an average height of about 125 ft., the production during the past 20 months amounting to about $300,000. Two winzes below the level are in the same good ore. Silver occurs in the ratio of about 10 to 1 of gold, by weight, but appears to be increasing with depth. There is much virgin ground above the tunnel level. At present, the trains of the tunnel are loaded directly from the Lake chutes and the ore is hauled, without transfer, to the mills in Idaho Springs.

BUTTE—July 20

Timber Butte Zinc Mill is to be enlarged according to an interview with ex-Senator W. A. Clark. With the opening of the war and the shutting off of the Belgium and German markets, the Australian output of zinc concentrates threatened to deluge the American market. "The Timber Butte company, however, was fortunate in having smelting contracts that protect it," said Senator Clark. "We have a contract that has three years to run yet with a company that has its headquarters in Germany but has an American branch and smelts the ores at its plants in Kansas and Oklahoma."

The Growing Activity of the East Butte District is clearly indicated by the fact that the Northern Pacific Railway Co. has ordered surveys to be made immediately for a spur to run from its main line to the Bullwhacker, Colusa-Leonard, Tropic, Butte & London and other mines. The plan is to branch off from present main line south of the Pittsmont property, and come around close to the Bullwhacker, then north to the Tropic and connecting with the Colusa-Leonard and the Butte Main Range shafts. The plan also calls for an extension to the Greenleaf and the Butte & London mines as soon as development work at these properties is completed. The building of the spur will mean much to the entire district in that it will afford shipping facilities to a number of working mines which are now dependent on hauling by team to the nearest railroad track.

SALT LAKE CITY—July 17

The First Unit of Sulphuric-Acid Plant, which the Garfield Chemical and Manufacturing Co. is building at Garfield, will be placed in commission in October. The steel work is almost entirely finished; and the chamber building has been so far completed that two of the chambers are ready for the lead burners; and two more will be ready shortly. Excavation for a second unit has begun. The plant is to have a capacity of 200 tons of sulphuric acid daily. If acid in excess of what is required by the Utah Copper is available other low-grade ores in the state may be treated.

Utah Mines Paid Dividends amounting to $10,915,000 during the first half of 1916. Fifteen mining companies contributed this wealth; six are in Tintic, three in Bingham, three in Park City, one in Big Cottonwood, one in Beaver County and one at Promontory in Box Elder County. The distribution during the six months amounted to $170,000 more than the total dividends in 1915. The properties are the Cardiff, Centennial-Eureka, Chief Consolidated, Daly-Judge, Horn Silver, Iron Blossom, Gemini, Lake View, Mammoth, May Day, Silver King Coalition, Silver King Consolidated, Utah Consolidated, Utah Copper and Utah Apex. These Utah mines have paid up to date dividends of $87,494,000.

LUNING, NEV.—July 20

The Southeastern Part of Mineral County, Nevada, has not attracted the attention warranted by its present activities. Recent tungsten discoveries southwest of Sodaville have been only one feature of the activity in the Pilot Mountains, tributary to Mina and Luning. About 500 miners are employed in the region and considerable amounts of copper ore and quicksilver are being shipped from these stations. Regular shipment of copper ore is made from mines east of Luning. Northeast of Mina copper mining is principally in the prospecting and development stage. Quicksilver production in this vicinity is mainly confined to the operations of Fullerton

& Drew and Pepper & Kehoe. The former company shipped 58 flasks of quicksilver in June; the other company less than that but made a good showing. At Sodaville a new 100-ton tungsten mill was given a tryout on July 1. The operating company, representing Atkins, Kroll & Co., of San Francisco, has valuable scheelite deposits 12 mi. southeast of Sodaville in the Excelsior Mountains. The company has bought up the townsite of Sodaville; installed an electric-light plant and otherwise begun the establishment of a permanent camp. It is probably a safe estimate that there are 600 miners, prospectors and teamsters employed in what may be termed the Luning and Sodaville districts, covering a region about 30 mi. long and 30 mi. wide.

DULUTH, MINN.—July 22

Conditions on the Mesabi Range are gradually righting themselves. At Aurora the Mohawk mine (underground) has resumed, and at Virginia the Victoria, Franklin and Union mines are again working. A large searchlight is employed nightly at the Franklin mine. At Biwabik on the night of July 19 a number of rifle shots were exchanged between the strikers and two deputies going from the Holland to the Ruddy mine; nobody hurt. George Parsons West, of the Federal Industrial Relations Department, has been on the range for some days, leaving for Washington on July 21, after having secured material for a government report on strike conditions. Statisticians figure the economic loss of this strike at $2,000,000. Nearly 2,000 men are now doing police duty on the range.

JEROME, ARIZ.—July 19

United Verde Copper Co. is now producing about 6,000,000 lb. of copper per month, and, according to an interview with ex-Sen. W. A. Clark, this will be increased to 10,000,000 lb. as soon as improvements now under way are completed. The plant is being steadily enlarged and additional crushing facilities are being installed. The reverberatories have been increased from three to five, and the fifth blast furnace is being added. The Wedge furnaces are being increased from six to twelve. The town of Clarkdale, situated about 4 mi. from Jerome and about 2,000 ft. lower in altitude, is being made a model town for United Verde employees. Three separate styles of houses are being built for different classes of employees. For the Mexican miners houses are built along lines preferred by them, of low construction and built of brick and made fireproof. The Mexican miners are segregated on the lowest ground. On a bench just above them a different style of house is built for white workmen, these houses being of two to six rooms each, with every modern convenience. The third series of houses are on another bench about a quarter of a mile still higher, these being intended for salaried employees who can afford to pay a better rental. All rentals are based on a low rate of interest return on the actual cost to the company for the construction. The company retains ownership, polices the town, and furnishes all accommodations. An uptodate schoolhouse has been built at a cost of $65,000, and another is under construction. A high school is also planned. The town of Clarkdale already has a population of 2,000 and is growing rapidly.

DOUGLAS, ARIZ.—July 21

Phelps, Dodge & Co.'s Arizona Headquarters will be moved from Bisbee to Douglas. With this change comes the announcement of several promotions in Phelps, Dodge & Co. Walter Douglas, who has been general manager, becomes vice-president with headquarters in New York. S. W. French, formerly general manager of the Copper Queen Consolidated Mining Co., will succeed Walter Douglas as general manager of Phelps, Dodge & Co. A. V. Dye, who has been assistant to Walter Douglas, will be assistant general manager of Phelps, Dodge & Co., with headquarters in Douglas. G. H. Dowell will be promoted from assistant general manager to manager of the Copper Queen company. Mr. Dowell was first connected with the Copper Queen as ore purchaser; later he was superintendent of the Old Dominion at Globe, leaving there about five years ago to become assistant general manager of the Copper Queen. Doctor Dye, the youngest member of the Phelps-Dodge organization in Douglas, gave up his position as American consul at Nogales four years ago to become assistant to Walter Douglas.

Ventilation at Bisbee Mines of the Copper Queen company has been made a subject of special investigation for some time and deep satisfaction is felt both by managers and miners in the manner in which the ventilation problems have been solved. Formerly the atmosphere in miles of the underground workings at Bisbee was anything but comfortable, and the efficiency of the workmen much reduced. Now, an engineer of special qualifications is kept on this work, his duty being to visit all places where poor air or gas might be found or where there might be conditions of excessive heat or humidity. As a result, working conditions have been improved vastly. Temperature generally is kept at 77° F., relative humidity under 85% , the air current in working places at 100 ft. per min. and the quantity of air at not less than 250 cu.ft. per min. for each workman. In the Lowell fire district the temperature has been lowered 4° and miners are relatively comfortable, for the air current is kept at 400 ft. per min., and the humidity has dropped from 98 to 80. Not only has ventilation been improved by means of shaft connections and doors, but blowers of large capacity are in general use. Several of these have been placed at emergency points, to control gas or smoke in case the fire should accelerate in any unexpected section of the workings.

JOPLIN—July 22

Radical Reduction in Price of Ore during the past two months has created a situation in the district in some measure unique, but not at all comfortable to the ore producers. The general arrangement with the miners regarding the sliding scale of wages based on the price of ore, naturally takes care of the proportionate labor cost at all market levels, but no such arrangement automatically reduces the price of the powder and mine and mill supplies. The point has therefore been reached where the price received for concentrates in many of the sheet-ground properties is but the cost of production, and in some cases below the cost of production, though the prices paid for ores is, relatively speaking, still high. Where powder formerly cost $4.50 per box, it is now $10.50. Where dynamite caps formerly cost 60c., they now cost $1.90. Steel, cable, belting, hard iron and many other items of supply have increased largely and the operator is feeling the pinch at present. As a result many of the sheet-ground operators shut down two weeks ago. Practically all mills in the sheet-ground district were recently closed for about 10 days by the breaking down of the chief unit of the Empire District Electric Co.'s power plant. This forced curtailment of ore production came at a time when it was most needed. The surplus stocks had reached a total of 28,000 tons, one of the largest surplus stocks ever accumulated in the Joplin district. Moreover, the increased output from the Miami field which can turn out concentrates at a cost of from $20 to $40 per ton profitably is rapidly increasing, and will automatically take the place of some of the sheet-ground mills. The situation therefore is not the brightest, especially as regards any radical reduction over a long period. The curtailment at present is temporary, but will probably prevent any rapid growth in the surplus stocks, which represented about three weeks' production.

TORONTO—July 22

The Nickel Controversy is increasing in intensity and occupies a large share of public attention. The situation is confused by a mass of conflicting reports, statements and denials from official and other sources, but two important features are sufficiently clear: (1) That the Canadian government has no present intention of yielding to the clamor of the agitators by placing any further restrictions on the exportation of nickel ore or matte; and secondly, that the Liberal party is determined to make all possible political capital out of the movement and make it a leading issue in the next election campaign. Hon. Arthur Meighen, Canadian Solicitor General, speaking at Hamilton, Ont., on July 20, warmly defended the position of the government on patriotic grounds, stating that had the export of nickel ore been interfered with many Canadians would have been thrown out of employment, and that before refining in Canada could be effected a dangerous delay would have resulted and the Allies would have been deprived of a rush delivery of munitions. He read the following cablegram from the British Secretary for the Colonies: "His Majesty's Government is fully aware of the arrangements made for assuring the destiny of the nickel refined from Canadian ore in the United States, and is satisfied with the precautions that have been taken to prevent such nickel getting to the enemy." Hitherto although many individual politicians and journals connected with the Liberal party have condemned the government's nickel policy, it has not been regarded as a party issue. The National Liberal advisory committee, which met in Ottawa this week to draw up a platform for the next election campaign, devoted much attention to the question, the concensus of opinion favoring the adoption of a plank demanding more effective safeguards against Canadian nickel reaching the enemy than those provided by the government. Formal action was deferred for a closer study of the whole question, and a general policy to meet the situation will be announced later by Sir Wilfred Laurier. A statement that the International Nickel Co. had secured a site for the contemplated branch plant in Nova Scotia is denied by representatives of the company, who are now making a tour of Ontario looking over a number of locations. The partly consists of R. C. Stanley, general superintendent of works; Clifford Branigan, chief engineer; Frank Ludlam, purchasing agent and W. L. Wetherspoon, consulting engineer.

The Mining News

ALASKA

KENSINGTON (Juneau)—New mill to be erected. Reserves estimated to average $3 per ton. S. Peabody Rogers, superintendent; Bartlett L. Thane, manager.

ALABAMA

TENNESSEE COAL, IRON AND RAILROAD CO. (Ensley)—Will install electric furnace for preheating ferromanganese; Bessemer blowing capacity to be enlarged.

ARIZONA

Cochise County

OUTPUT OF DOUGLAS SMELTERIES for June approximated 21,000,000 lb. copper; Copper Queen, 13,500,000, and Calumet & Arizona, 7,500,000 lb.

DR. GEORGE H. FRENCH will soon begin shipping silver-lead ore from four claims near Niggerhead Mountain, 9 mi. east of Douglas.

Greenlee County

ARIZONA COPPER (Clifton)—June copper production about 4,800,000 lb.

Mohave County

GOLD ROAD (Goldroad)—Press reports state mine shut down account miners' strike for more pay.

PAYROLL (Chloride)—Hoisting from 400-ft. level resumed after recent inflow of water; crosscutting to main vein.

JOHNNY BULL (Chloride)—Started sinking 300-ft. shaft on south extension of Tennessee vein.

SCHENECTADY (Chloride)—Telluride and Chloride L. M. and M. Co., now working this property, has incline shaft down over 120 ft.

BOUNDARY CONE (Oatman)—Driving on 750 level both in east and west drifts; south crosscut from west drift has just entered the orebody.

OATMAN CRESCENT (Oatman)—Adit in 330 ft. and is expected to reach its objective about Aug. 15. Vein on surface 10 to 20 ft. wide; sampled for 800 ft. with fair results.

Maricopa County

PHOENIX CUSTOM SMELTER CO. (Cavecreek)—New organization, capitalized at $3,000,000, to erect custom smeltery in Cavecreek district. J. G. Harden, president of the Slocum Copper Co., Cavecreek, president.

Pinal County

AJAX (Superior)—Main shaft, down 195 ft., will be sunk to 600-ft. point.

WOODBURY COPPER (Superior)—Sold to Colorado and Washington men for $200,000; will begin work Aug. 1.

PACIFIC (Superior)—Several carloads 30% copper ore shipped; more on dump; Eastern men negotiating for purchase.

ARIZONA BONANZA COPPER (Superior)—Will be explored by drilling as soon as road is completed to property 6 mi. from Superior.

A. L. GARFORD ASBESTOS MFG. CO. (Superior)—This company, of Elyria, Ohio, is negotiating for purchase of asbestos claims of H. B. Riggs, S. E. Douglas, and Phil Connelly.

GILA DEVELOPMENT CO. (Kelvin)—Organized by Charles H. Barney, of Boston, to develop the Cane Springs gold claims, 1½ mi. south of Troy. Roy G. Mead, managing director.

MINERAL DEVELOPMENT CO. (Redrock)—This company, composed of L. S. Cates and others of Ray Consolidated staff, is developing Aguirre mine and shipping some copper-carbonate ore to Sasco smeltery. Ray Consolidated company not interested, as reported in daily papers.

Yavapai County

BLACK ROCK, LTD. (Wickenburg)—Free-milling gold ore struck on 425-ft. level.

HOMESTEAD (Walker)—A 3-ft. body of milling-grade gold ore encountered at 75 ft. depth.

GOLD BLOSSOM MINING (Prescott)—High-grade lead-silver ore opened at 185 ft.; will sink to 200 ft. before drifting.

JEROME-VICTOR (Jerome)—Unwatered to 550-ft. level; lowering water about 100 ft. per week; retimbering shaft; George W. Salisbury, superintendent.

THREE MEDALS (Jerome)—Carload machinery, including hoist and compressor, expected in few days; shaft down 175 ft.; Ramon Martinez in charge.

Yuma County

BLACK REEF COPPER (Wenden)—Gasoline hoist ordered; shaft now down 120 ft. The 2-ft. copper-gold vein at surface is 6 ft. wide at 100-ft. depth.

PLOMOSA PLACER (Vicksburg)—Williams-Quenner mill and Stebbins dry concentrator to be in operation by August. A. Maltman, superintendent.

FLYING DUTCHMAN AND BLUE STATE (Quartzite)—Owned by Fenchler, Murray and Fenchler, of El Paso; main shaft 175 ft. on way to 300-ft. point; free-milling gold ore.

WENDEN COPPER (Wenden)—New organization to develop 12 all-copper claims of Sydney P. Osborn and James Burson in Cunningham Pass district. Machinery will be installed soon.

CALIFORNIA

Amador County

PLYMOUTH CONSOLIDATED (Plymouth)—Report of Superintendent James F. Parks for June: Crushed 11,400 tons of ore, valued at $56,685. Working expenses, $28,000; development, $7,321. Surplus, $21,364. Other capital expended, $15,525.

Butte County

BUTTERFLY (Oroville)—Gold-bearing gravel 4 ft. deep reported struck while driving 500-ft. tunnel from Morris ravine; width of gravel bed being determined by crosscut. Operated by C. F. Belding and associates.

Eldorado County

HORSESHOE BAR (Georgetown)—Machinery being hauled from railroad through Georgetown by motor trucks to middle fork of the American river. Mine being prospected with a view of installing a dredge. Part of ground hydraulicked in early days.

EUREKA SLATE QUARRY (Slatington)—Again reported that property will be operated, this time by the Sierra Slate Corporation of New York. This slate was used extensively several years ago, having been adopted as acceptable in Federal work. Reported that company will market 1,000 to 3,000 squares per month.

MONTEZUMA (Nashville)—Shaft on June 15 had reached 980 ft., 150 ft. having been made in first half of month. Developing on the 300, 500 and 800 levels. The large vein will be drifted on north and south and by crosscuts on 1,000-ft. level. Assays ranging from $5 to $30 obtained on the 500 and 800 levels. Property is being developed by William J. Loring and George Wingfield. The adjoining property, Havilla, is also under bond; development will depend largely upon results in the Montezuma.

Inyo County

CERRO GORDO (Keeler)—The large body of zinc ore, recently disclosed on the 200 level, proved to further depth by 50-ft. winze, showing orebody same in size and character.

MONTEZUMA (Big Pine)—Mine, situated 7 mi. southeast, recently reopened by John Mitchell, of Los Angeles. Producing high-grade silver-lead ore from orebody 70 ft. long; hauled by motor trucks to Zurich.

CHIPMUNK (Bishop)—This tungsten claim and the Two Warriors, situated in Little's Cañon, southwest of Bishop, have been taken on bond and lease by J. J. Gunn, representative of San Francisco men; owned by L. W. Munzinger, W. H. Gibson and William Nourse.

Kern County

SUNSHINE (Randsburg)—Shaft on Illingworth & Jewett lease down 50 ft. and drift being run north and south on a small vein of low-grade scheelite ore; producing about 200 lb. of tungsten concentrates per day. Hoist will be installed.

PAGE (Randsburg)—The I. C. L. lease, operated by Robert Lanka, C. G. Illingworth and Thomas Colburn, in the Stringer district, reported to have developed rich strike of tungsten. Five tons of 15% ore have been taken out; 200 lb. of high-grade per day being mined from a narrow vein.

Nevada County

TEXAS (Nevada City)—Mine in Willow Valley being reopened by W. H. Tuttle, of Nevada; 25 men employed cleaning up the old works and installing a 600-ft. pipe line. Unwatering.

SULTANA (Grass Valley)—Development in lower levels to be undertaken with view of finding extension of the Empire vein system. Mine equipped.

Placer County

ALGO (Lincoln)—This copper mine to be reopened. B. C. Musher, cashier of the Bank of Lincoln and H. P. Sartain, of Hotel Burdge, are principal owners. Hoisting machinery has arrived.

ADVENTURE (Colfax)—Reopening this property in Shirt Tail Cañon, Iowa Hill district, by tunnels. Installation of 5-stamp mill and concentrator.

Plumas County

SENECA CONSOLIDATED (Seneca)—Orebodies in the Del Monte and White Lily being developed by tunnel and shaft. Mill not yet in operation.

ENGELS COPPER (Keddie)—Preparations to increase mill to 1,500 tons per day; extensive exploration beyond main orebodies; 4,000-ft. tunnel being driven to tap main orebodies at 750-ft. greater depth.

Shasta County

MAMMOTH COPPER (Kennett)—Labor demands settled by increase of 50c. per day, when copper is over 15c. Fire on July 25 nearly destroyed mine surface equipment.

BALAKLALA (Coram)—In year ended June 30, shipped 76,000 tons of ore yielding net profits of $175,000. About $25,000, or 33⅓c. per ton, was spent in development work. Will increase development allotment to 50c. per ton; chiefly in diamond-drill exploration from lower workings. Shipping 300 tons daily to Kennett smeltery on 10-year contract. Initial dividend of 25c. will be paid by holding company, First National Copper Co., which has 600,000 shares outstanding.

Tuolumne County

HARVARD (Jamestown)—John Hernandez, 25 years old, killed by falling rock in north stope on 1,850 level. Hernandez and partner were barring down loose rock preparatory to drilling.

COLORADO

Lake County

BERTHA (Leadville)—Lease taken on this Breece Hill property.

HUGH LEASE (Leadville)—Production of 50 tons gold ore per week being made; new equipment being added. Property near head of South Evans gulch.

ONYX (Leadville)—New camp buildings being erected and more men put at work on the crosscut adit being driven by contract from Half Moon Gulch into French Mountain.

Mesa County

NATIONAL RADIUM PRODUCTS CO. (Grand Junction)—Enlarging its experimental plant to 200-mg. basis per month. Will develop its carnotite holdings in Utah. George Kunkle, president.

Montrose County

HART (Montrose)—Carload of carnotite ore recently sold to National Radium Institute.

San Miguel County

CONCENTRATE SHIPMENTS from Telluride in June were: Tomboy, 51 cars; Smuggler-Union and Black Bear, 29 cars to Durango and 18 cars to Blende; Liberty Bell, 12 cars; Alta Mines Co., 4; Sheridan, 3; total, 117 cars.

DUFFY (Ophir)—B. W. Purdy and associates developing on lease.

TOMBOY (Telluride)—Two 6½-ton electric locomotives recently installed at mine.

PRIMOS CHEMICAL (Vanadium)—This company purchasing iron-sulphide ore from the Lizzie G. at Sawpit.

SILVER GLANCE EXTENSION (Telluride)—Low-grade silver-lead ore opened in this property on Boomerang Hill.

MATTERHORN MINING AND MILLING (Ophir)—Properties being developed under direction of Frank Ensign.

SANTA CRUZ (Ophir)—Under lease to Wichmann & Fantone, who recently shipped two cars of sorted high-grade ore from development.

WELLER MINING AND MILLING (Telluride)—This company's Ballard mine being operated by Anderson & Lacey, lessees, who have started 10-stamp mill.

BUTTERFLY (Ophir)—This old property now being operated by the Jurich Leasing Co.; mill running at full capacity under superintendence of Stephen Lacey.

LITTLE MARY MINES CO. (Ophir)—Has taken over properties of Lake Superior-Ophir Mining Co. Crosscut is being advanced on the lower level under contract. Machine drills installed. S. E. Smith is manager.

SILVER BELL (Ophir)—Main raise, being driven by Samuel Richards under contract, rapidly nearing completion. Frank Trumble, manager. Tungsten lease, developed by Hill, Krise & Baer, sold to Foyle & Acaley for $4,000.

San Juan County

NEW TUNGSTEN STRIKE made near mouth of Minnesota Gulch in Silverton district.

HERMES (Animas Forks)—Development will be resumed under Joseph Warner.

O'MALLEY (Silverton)—Stringers of hübnerite opened in this Minnesota Gulch property.

BELCHER (Silverton)—This old silver-lead-zinc mine on Sultan Mountain recently bonded.

TRY AND TRUST (Silverton)—Development work on this tungsten prospect under way.

SILVER LEDGE (Chattanooga)—Mill being overhauled by lessees; good supply of ore in bins and broken in mine.

NORTH STAR (Silverton)—Development resumed at this Sultan Mountain property under management of Mr. Slattery; hübnerite streak opened.

CONGRESS (Chattanooga)—Being developed under lease by James Pearson and associates. Trial shipment of copper ore made. Dumps being hand sorted for copper ore.

BEN BUTLER (Animas Forks)—Development will be resumed under management of Frank Jackson, of Ouray. Compressor plant and machine drills being installed and power house remodeled.

LINWOOD (Silverton)—Heavy sulphide ore, 5 ft. wide, opened recently in new tunnel at 20-ft. point. Shoot carries chiefly galena, sphalerite, pyrite and chalcopyrite, with increasing amount of gray copper.

SILVER CROWN MINING AND DEVELOPMENT CO. (Silverton)—Developing Lee mine near mouth of Burns Gulch, under superintendence of D. P. Hill. Main adit advanced 150 ft.; vein 8 to 12 ft. wide, contains from 2 to 3 ft. of payable ore.

Summit County

ELDORADO (Breckenridge)—Driving crosscut tunnel into east spur of North Star Mountain to cut shoot of good-grade gold ore opened higher up hill.

PHILADELPHIA MINES CO. (Montezuma)—Now operating Toledo, Jumbo and Philadelphia mines; treating ore in Toledo mill, operated by electric power from Colorado Power Co. New compressor installed in mill recently to supply air for drills at mines.

ORO EXTENSION LEASING CO. (Breckenridge)—Operating old Oro ground in French Gulch. Building new 30-ft. headframe and installing new hoist, compressor and sinking pump. Will sink to 300-ft. level and explore lead-silver vein discovered in dredging work in French Gulch.

MONTEZUMA MINES AND MILLS CO. (Montezuma)—Now operating Silver Wave, Chatauqua and Princess mines. Ore milled at Silver King mill. Planned to build mill near junction of Deer Creek and Snake River where ore from all three mines can be transported by aërial tramways.

IDAHO

Shoshone County

CONSOLIDATED INTERSTATE-CALLAHAN (Wallace)—Purchase of Nipsic group of seven claims on the north for $111,200 approved at shareholders' meeting.

REX CONSOLIDATED (Wallace)—Eastern bankers have arranged capital necessary for development and reconstruction of tram and mill; 65,000 tons blocked out; production to begin in autumn.

SILVERADO MINING CO. (Old National Bank Building, Spokane, Wash.)—Company owning 21 claims near Osborn is building 75-ton flotation mill to treat the silver-lead ore opened by its 4,000-ft. tunnel; orebody exposed for 200 ft. W. H. Farrar, superintendent.

MINNESOTA

Mesabi Range

WANLESS (Virginia)—A 50-kw. 250-volt direct-current generator installed to furnish current for underground and surface tramming. Generator is driven by a Unaflow engine. Duplicate installation made at the Shiras mine.

Vermilion Range

PIONEER (Ely)—New concrete boiler house being built at "A" shaft. Repair shop, 40x165 ft., and wareroom, 28x36 ft., also being erected.

SIBLEY (Ely)—The Oliver company sinking new shaft, 11 ft. by 20 ft. 9 in; five compartments, one for cage, two for skips, one pipe-and-ladder way and one for counterbalance. Shaft being sunk at inclination of 68° 30', with an inclined depth of 1,201 ft. Steel shafthouse from the Savoy mine will be moved to new shaft.

MONTANA

Madison County

ALDER CONSOLIDATED (Virginia City)—Brayson & Moore, of Virginia City, operating this Alder Gulch placer under lease, are preparing for first cleanup of season.

Silver Bow County

GOLD HILL (Butte)—This gold property, in the Highlands. 25 mi. south of Butte, is being reopened and 10 men are at work.

EAST BUTTE EXTENSION (Butte)—Shipment of 70 tons of 4% ore from the 200 level was made from this property to Pittsmont smeltery.

BUTTE & LONDON (Butte)—North crosscut on the 1,600-ft. level intersected barren stringer, 100 ft. from shaft, at first thought to be the vein cut in the shaft 200 ft. above. Crosscut will be continued.

BUTTE & GREAT FALLS (Butte)—Crosscut on 500 level cut the Dewey vein on July 14; third vein cut in this crosscut, the others being the V. G. and the Genevieve. Drifting on these veins will be started immediately. Mine in extreme northrn section of camp.

ANACONDA (Butte)—Contract let for sinking three-compartment shaft at the Nettie from 500 ft. to 1,500 ft. First deep shaft in the western part of Butte district, except Butte & Zenith City shaft, which is being sunk to the 1,000-ft. level ½ mi. west of the Nettie. Company has exercised its option on 100,000 additional shares of the Butte Copper & Zinc Co.; now holds 188,000 of 500,000 shares; under terms of contract property must be opened to 1,600 level; sinking will be started soon.

NEVADA

Lincoln County

UVADA COPPER (Pioche)—Shipped 29 cars in June, or about 40 to 50 tons daily of copper-silver and lead-silver ore. M. M. Johnson, Salt Lake City, Utah, manager.

Mineral County

WEDGE COPPER MINING (Reno)—Driving tunnel on middle vein which is averaging 6%. Mine is 6 mi. from Luning, equipped with 60-hp. compressor and company intends developing for one year to determine if property warrants reduction plant. Mark Walser, president.

Nye County

TONOPAH ORE PRODUCTION for week ended July 15 was 10,360 tons, valued at $212,560, compared with 8,038 tons for week previous. Producers were: Tonopah Belmont, 2,824 tons; Tonopah Mining, 2,800; Tonopah Extension, 2,200; Jim Butler, 1,250; West End, 841; Rescue-Eula, 223; Halifax, 157; miscellaneous, 65 tons.

JIM BUTLER (Tonopah)—June profit $22,829 from 3,098 tons, treated under contract at the Millers' plant of the Belmont company.

TONOPAH BELMONT (Tonopah)—June profit $116,847 from 12,074 dry tons. Bullion yield was 2,399.95 oz. gold and 230,651 oz. silver.

WEST TONOPAH (Tonopah)—Sinking shaft on three shifts. Station will probably be cut at 1,050-ft. level and work done on vein encountered at 870-ft. point.

TONOPAH BONANZA (Tonopah)—Shaft down 1,560 ft. and occasional quartz stringers being cut. Plan to sink to 1,650 ft., where station is to be cut.

Storey County

SIERRA NEVADA (Virginia)—Old east crosscut 2,400 level repaired to 112-ft. point; north drift 2,500 level reopened to 116-ft. point.

CON. VIRGINIA (Virginia)—South drift just west crosscut 2,700 level advanced to 213-ft. point, face in vein porphyry carrying stringers of quartz.

MEXICAN (Virginia)—Continued advancement of west crosscut No. 2, face mixture of porphyry and quartz of low assay at 40-ft. point. Mexican mill received 449 tons custom ore, average assay $26.30.

UNION CON. (Virginia)—Extracted 386 tons from 2,400 and 2,500 levels, gross value about $12,000. Repaired southeast drift from 2,500 station to 170-ft. point. Sierra-Union 2,500-

2,900 winze reopened to 25-ft. point. Union shaft repaired to 169 ft. below 2,500 level.

CROWN POINT-BELCHER (Gold Hill)—Saved 40 cars of ore from 300 level in prospecting and cleaning; repairs made on 1,400 level (shaft and electrical equipment). Jacket mill received 729 tons dump rock, 40 cars of ore.

NEW MEXICO

Grant County

SANTA RITA DEVELOPMENT (Santa Rita)—New organization to develop property adjoining the Chino, capitalization $100,000; incorporators are Elmer S. Morton, of San Francisco; W. W. Lawson, B. A. Richardson and E. C. Bradford, of Douglas; H. W. Loomis, of Silver City is statutory agent.

85 MINING (Lordsburg)—The 450-hp. Diesel engine exploded, leaving mine without power until duplicate engine, ordered recently, arrives.

Guadalupe County

PINTADO CONSOLIDATED COPPER CO. (Santa Rosa)—This new company is building a 100-ton leaching plant, after plans of J. L. Matt, to operate on a sandstone copper deposit in Pintado Cañon. Barren layer of sandstone, 6 ft. thick, overlying deposit, will be removed and ore quarried; copper-bearing layer 12 ft. thick exposed in tributary cañon. Several cars shipped to El Paso averaged better than 3% copper. Townsite being laid out. C. H. Taggert, president.

Socorro County

GOLD EAGLE (Mogollon)—This group, owned by Louis Gramas, has begun shipping.

EBERLE (Mogollon)—Oaks Co. has begun drifting north and south on Queen vein; shaft now unwatered and ore being shipped to custom mill.

SOCORRO MINING AND MILLING (Mogollon)—Pacific mine shaft retimbered and electric power brought to property. Shipments to mill will begin as soon as aërial tramway is completed.

ALBERTA MINING AND DEVELOPMENT (Mogollon)—Manager A. H. G. Palmer is in camp, arranging for reopening. The workings comprise 300-ft. adit and drifts east and west. Some good ore developed.

PENNSYLVANIA

BETHLEHEM STEEL (South Bethlehem)—Orders placed with Maryland shipbuilding plant for five steel ore vessels to serve the company's properties in Chile and Cuba. The new boats—some of 17,000 tons and some of 11,300 tons carrying capacity—will be operated by the Ore Steamship Corporation, a Bethlehem Steel subsidiary.

SOUTH DAKOTA

Custer County

OLD MIKE MICA (Custer)—Dispute over ownership settled and property shipping mica regularly.

CUYAHOGA (Custer)—One car of copper-sulphide ore shipped to the East. New hoist will be installed.

Lawrence County

ORO HONDO (Deadwood)—Exploratory work continues on 2,000-ft. level; diamond drills extensively used.

MOGUL (Terry)—Mill running steadily on good-grade ore, mainly from Ofer and Two Johns mines. At the latter, the 4,000-ft. tramway to the railroad completed.

HOMESTAKE (Lead)—New tungsten concentrator working two 8-hr. shifts per day. W. H. Butler recently took contract to haul 30 tons of ore daily from mine to mill.

TROJAN (Trojan)—Mine and mill operating nearly at capacity, 350 tons daily. Installation of revolving drum filters is planned; stationary leaf filter now being used.

WASP NO. 2 (Flatiron)—Tungsten concentrator is treating 25 to 30 tons daily averaging 1.25% tungstic acid. Jigging is followed by table concentration, final recovery being made on canvas tables. Cyanide mill continues to operate on ore from underground workings in westerly part of property.

Pennington County

HILL CITY TUNGSTEN DISTRICT is scene of great activity. Black Hills Tungsten Co. is operating concentrator. Hill City Tungsten Production Co. completing installation of machinery in old Harney Peak tin mill at Hill City; will treat some custom ore and stimulate mining, affording a market for many small mines.

NEW GOLDEN WEST (Rochford)—Crosscut tunnel advanced over 400 ft., has entered orebody. Compressor plant started.

U. S. GYPSUM (Rapid City)—Mill destroyed by fire will not be rebuilt. Company acquired property near Piedmont and will erect fireproof plant there immediately; deposits large and of good grade.

UTAH

Juab County

TINTIC SHIPMENTS for the week ended July 14 amounted to 191 cars.

VICTORIA (Eureka)—Property, acquired by Eagle & Blue Bell, being opened by drifts from the 1,000- and 1,300-ft. levels of the Eagle & Blue Bell.

IRON BLOSSOM (Silver City)—Utah and Juab counties are again in controversy over taxes paid by this company, which owns ground in both counties.

EAGLE & BLUE BELL (Eureka)—Installation of $35,000 electric hoist made and new development undertaken; shaft down 65 ft. below 1,700-ft. level. Shipments averaging 65 cars monthly. Earnings for second quarter about $55,000.

Salt Lake County

YAMPA (Bingham)—This property is being worked to the 1,600 level; shipping 200 tons daily of 3 to 4% ore.

UTAH METAL AND TUNNEL (Bingham)—In six months ended June 1, earned $600,000 net or nearly $1 a share. Development expenses unusually heavy. Production from Bingham-New Haven workings, first 10 days of June, amounted to 1,255 tons of milling ore, 105 tons of lead and 332 tons of copper ore, which was shipped. The Utah Metal workings produced 746 tons of milling ore and 218 tons of copper shipping ore. Seven sets of lessees operating in old upper workings.

BINGHAM MINES (Bingham)—Earnings for second quarter, including profits from Eagle & Blue Bell at Tintic (of whose stock Bingham Mines owns 75%) were $82,000. The Bingham properties earned a little over $40,000 for the period, May, with $15,426, showing largest monthly earnings. Outstanding bonds have been reduced to $250,000.

Tooele County

INTERNATIONAL SMELTING (Tooele)—Cottrell system, being installed at sintering plant, is approaching completion Two units expected to be ready July 22 and remaining two in about a month.

Utah County

ALPINE EMPIRE (American Fork)—Control taken by Jesse Knight.

BAY STATE (American Fork)—Tunnel is in 225 ft.; face in brown limestone. Three shifts working.

EARL EAGLE (American Fork)—New road completed to property. Machinery being installed for more active development.

PACIFIC (American Fork)—Fifteen men are working. New orebody opening satisfactorily. Machinery for mill being loaded at American Fork.

CANADA

British Columbia

CONSOLIDATED MINING AND SMELTING (Trail)—New sulphuric-acid plant completed. Initial capacity, 10 tons daily. Hydrofluosilicic acid is also made. Recently shipped 250 tons electrolytic zinc to Great Britain; capacity of zinc plant expected to reach 30 tons daily in August. Electrolytic copper refinery producing about 35 tons daily.

ROCHER DE BOULE COPPER CO. (Tramville)—Shipping 1,500 tons monthly to Tacoma smeltery but expect to increase to 3,000 tons when 500-ft. level is more extensively opened. Crosscut adit being driven to open workings 1,000 ft. below 300-ft. or old-tunnel level. Former leasing company, Montana Continental Development Co., of Butte, erected aërial tramway, narrow-gage railroad, 225-hp. hydro-electric plant, modern camp buildings, ore bins at Prince Rupert, B. C., and shipped 23,000 tons, averaging 7.25% Cu and carrying some silver and gold. D. J. Williams, manager.

Ontario

ORE SHIPMENTS FROM COBALT in June over Temiskaming & Northern Ontario Ry. were: Aladdin, 26.77 tons; Beaver, 47.87; Cobalt Comet, 82.38; Coniagas, 68.29; Crown Reserve, 121.91; Kerr Lake, 155.48; La Rose, 130.75; McKinley-Darragh, 195.54; Mining Corporation of Canada, Cobalt Lake, 129.35, and Townsite City, 169.07; O'Brien, 31; Penn Canadian, 85.76; Peterson Lake, 79.11; Temiskaming, 42.04; Casey Cobalt (New Liskeard), 63.30; Wettlaufer (South Lorrain), 12.26; total, 1,440.88 tons. Alexo nickel ore (Pourquois Jctn.), 848.35 tons.

DOMINION REDUCTION (Cobalt)—Installing flotation to replace cyanide treatment.

MILLER INDEPENDENCE (Boston Creek)—Purchased Leach Veteran claim adjoining the Miller.

HUDSON BAY (Cobalt)—Recently reopened; discovered lens of high-grade ore above 300-ft. level.

KING EDWARD (Cobalt)—Installing flotation and will dredge old tailings from lake and treat them.

WEST DOME CONSOLIDATED (Porcupine)—Will sink new four-compartment shaft near center of property.

NORTH THOMPSON (Porcupine)—Shaft down 460 ft. and four levels opened with satisfactory results. Ore above average grade found on 400-ft. level. Another level will be run at 500 ft.

VIPOND—Report for quarter ended June 30 shows loss in operation. Tonnage milled was 10,185 and bullion produced $37,000; average value of $3.69 per ton; operating costs, $4.45 per ton. Expect to treat better grade ore from 400-ft. level.

McINTYRE (Porcupine)—In quarter ended June 30, milled 34,173 tons, averaging $8.29, and recovered $241,650. Operating cost per ton was $4.23; total operating profits, $122,064; treated 3,721 tons of customs ore. Extra settling tanks ordered to bring mill capacity up to 500 tons.

CUBA

CONSTANCIA (San Ignacio 54, Habana)—Maximilian Paetzold, Austrian consul at Habana, has made preliminary shipments of 15% copper ore from this old mine in Pinar del Rio; new lens has been opened.

MATAHAMBRE (Apartado 1795, Habana)—Manuel L. Diaz, principal owner of this copper mine in Pinar del Rio Province, has arrived in New York to purchase concentrating equipment for the second-class ore. C. L. Constant & Co., 44 New St., New York, engineers.

WEST INDIES MINES DEVELOPMENT CO. (25 Broad St., New York, U. S. A.)—Organized by L. E. Whicher and associates of New York to explore and operate on royalty basis certain copper prospects in Province of Pinar del Rio, Cuba, and also in the Republic of Hawaii. Hermann A. Keller, of New York, is consulting engineer, and will be in Cuba for the next few months. His address is care of Dr. A. F. Guiteras, Milanes 57, Matanzas.

CHILE

BRADEN (Rancagua)—May copper production, 1,941 short tons; June, 1,129 tons; mill closed about two weeks account repairs to tailings dam. Copper production, first half of 1916, 11,555 tons. Equipment ordered for extension of reduction works, which are to have capacity for treating 10,000 tons of ore daily by March, 1917; present daily capacity, 4,500 tons.

ASIA

Chosen

ORIENTAL CONSOLIDATED (Unsan)—Final return for May: 200 stamps ran 29.7 days crushing 27,173 tons. Gross receipts, $133,908; operating costs, $76,404; operating profit, $57,503; development and betterment, $3,704; net profit, $53,799.

The Market Report

Metal Markets

NEW YORK—July 26

During the last week copper apparently touched bottom, a sharp rally following and the advance being held firmly. The rally in spelter went further, but ultimately culminated, the price receding again toward the close. The lead market was considerably confused but manifestly was weaker.

The N. Y., N. H. & H. Ry. put a new embargo on eastbound freight into effect at midnight July 26-27.

Copper, Tin, Lead 'and Zinc

Copper—On July 20 some rather large sales were made at 23c., r.t., and on the following day further business was done at the same price, but other producers entering the market at that time were able to get 24c., r.t. About all of this business was domestic and was to a large extent covering by manufacturers who had previously sold their finished products without contracting for the raw material. On July 22 a round lot was sold for export at 23c., net cash, but by the end of the day 24c., or 24¼c., r.t., was realized on domestic business in quantity. On July 24 business was done at 24½c., r.t., and on July 25, at 25c., r.t., but there were still sellers at 24½c., r.t. The same conditions continued to prevail on July 26. The business that was done was chiefly for September, October and September-November deliveries. For delivery in the last quarter there continued to be sellers at concessions, 23½c., r.t., being offered at the close.

Business was done during the week from day to day and the aggregate of what we had reports was of respectable proportions. The major part of it was for domestic account, although there were some export sales. The resiliency exhibited by the copper market during the week was quite satisfactory and the opinion was expressed in the trade that a definite turn had come about. The hope was expressed, however, that the large producers would reënter the market at a reduced level and exercise a restraining influence against a further advance.

Copper Sheets are nominally unchanged at 37½c. per lb. for hot rolled and 38½c. for cold rolled. Copper wire is 29@30c. per lb. for carload lots at mill.

Tin—Practically nothing was done in this metal; the price advanced slightly, following the London market.

Bolivian Tin Ore Shipments for the six months ended June 30, 1916, were equivalent to 9,700 tons tin, 7,168 tons going to Great Britain and 2,455 tons to the United States. For the corresponding half of 1915 shipments were equivalent to 11,467 tons tin, 11,381 tons to Great Britain and only 86 tons to the United States.

Lead—The situation in this metal, especially as to price, was more confused than ever. In the St. Louis market there was no doubt about there being a softer tone, sales of Missouri lead being made at gradual concessions, business being reported done as low as 6c. on July 26. In the New York market the principal producer reported sales of desilverized lead at 6.50c., but other producers of desilverized reported the offering of tonnages at 6.20@6.25c. and inability to effect sales. There was similarly a discrepancy among reports as to volume of business. One large producer reported more done than in the previous week, but sales of others were less. The confusion of views and ideas was well reflected by the offers for the delivery of 225 tons of lead to Frankford Arsenal, which takes the Philadelphia freight rate, these bids being opened on July 25. The Pennsylvania Smelting Co. offered at 5.98c., the United States, at 6.15c., Caswell & Starke, at 6.24c., the American Metal Co., at 6.30c., and another brokerage house, at 6.60c.

The labor and political situation in Spain continued unsettled. It is reported no worse, but it remains a factor of potential importance in the market.

Spelter—The market continued to advance under the impetus received in the previous week. The chief feature was the sale of a large block for export, delivery running far ahead. This business was done at a price much below the current market, and probably constituted a back-log for the latter. The business for near-by delivery was well divided among the producers and in the aggregate attained fair proportions without anyone doing a specially large amount. This business was chiefly for domestic account, including some with galvanizers. Subsequent to July 24, however, the demand petered out and the market promptly receded. The facts that numerous consumers are known to be overbought and that some of them are offering round lots for resale, while others are endeavoring to arrange postponement of deliveries, do not tend to give the market any great stability. On the other hand, a potential demand from Europe at a lower level is considered to be an insurance against a severe decline.

DAILY PRICES OF METALS IN NEW YORK

July	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
20	4.7575	62¼	22½ @23	37½	6.20 @6.25	6.10 @6.20	8.75 @9.25
21	4.7581	63⅜	22¾ @23¾	37½	6.20 @6.25	6.05 @6.15	8.75 @9.25
22	4.7581	63⅜	23 @24	37¾	6.20 @6.25	6.00 @6.10	9.00 @10.00
24	4.7581	63½	24 @24½	38	6.20 @6.25	6.60 @6.10	9.50 @10.00
25	4.7581	62⅞	24¼ @24⅜	38¼	6.20 @6.25	6.00 @6.10	9.25 @9.75
26	4.7581	63½	24¼ @24⅜	38¼	6.20 @6.25	6.00 @6.05	9.00 @9.50

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are as reported by Handy & Harman and are in cents per troy ounce of silver bars 999 fine.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

July	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
20	29⅞	90½	88	121	25.76	166⅜	167	28½	6.06	51	10.86
21	30 3/16	91	89	122	25.98	168¼	168¾	28⅝	6.09	54	11.50
22	30 3/16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
24	30⅛	94	91	122	25.98	166¼	167	27¾	5.91	56	11.92
25	29 15/16	98	95	122	25.98	166	166½	28¼	6.01	60	12.77
26	30⅛	100	98	122	25.98	165½	166¼	28	5.96	59	12.56

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅟c.

Zinc Sheets are in good demand, both for domestic deliveries and for export. The quotations are unchanged at $15 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

Other Metals

Aluminum—There is no change in the market. Demand continues fair and deliveries seem to be sufficient. Quotations continue at 59@61c. per lb. for No. 1 ingots, New York.

Imports of aluminum in May are reported at 1,391,575 lb., against 418,708 lb. in May of last year.

Antimony—The market was dull, but some new inquiries were reported. We quote spot at 13½c.; the principal interests were unwilling to quote futures.

Quicksilver—The market is quiet but steady. We quote $80, New York. San Francisco reports by telegraph $79, market dull.

Minor Metals—Current quotations for **Bismuth** are $3.15@3.30 per lb., New York.—**Cadmium** is quoted at $1.30@1.50 per lb.—**Cerium,** electrolytic, is sold at $8@9 per lb.—**Cobalt Metal** is quoted at $1.25 per lb.—**Magnesium** is lower, with sales at $3.50@3.75 per lb. for 99% pure.—**Selenium** is from $3 up to $5 per lb., according to size of order.

Gold, Silver and Platinum

NEW YORK—JULY 26

Gold continues to arrive in New York. This week a consignment of $20,000,000 from London by way of Halifax was received.

Gold in the United States July 1 is estimated by the Treasury Department as follows: Held in Treasury against gold certificates outstanding, $1,565,879,989; in Treasury current balances, $234,888,296; in banks and circulation, $639,153,647; total, $2,439,921,932, an increase of $446,372,917 over July 1 of last year.

Platinum—This market was dull and unchanged from the close last week. We quote $60, and at the close not very strong at that.

Our Russian correspondent writes from Petrograd that the market is rather dull and inactive. The demand has sensibly decreased, especially from abroad. From Ekaterinburg it is reported that the production of platinum has further increased, therefore a decline in prices may be expected. The producers and dealers affirm, however, that the dullness is temporary only and that the market will return to the former position. Prices remain generally unchanged. For crude metal, 83% platinum, the quotations are: In Petrograd, 64,000 @65,000 rubles per pood; at Ekaterinburg, 17 rubles per zolotnik. These are equivalent to $63.21 and $63.92 per oz. respectively.

Silver—The market continues without special feature. China exchanges remain below London parity, so that there is not much prospect of an inquiry for silver from that quarter to compete for the business offering.

Mexican dollars were quoted in New York, July 20, at 48⅛@52⅛c.; July 21, at 47@51c.; July 22 at 44⅞@48⅞c.; July 24 at 48¾@52¾c.; July 25 at 48½@52½c., July 26 at 48¼@52¼c. There was a quick recovery from the fall on July 22.

Zinc and Lead Ore Markets

Joplin, Mo., July 22—Quotations are as follows: Base price per 2,000 lb., ore assaying 60% zinc, $75 for premium ore; $70@60 for medium; down to $55 for low grade. Average price realized for week's sales, $68.41; highest price, $76.90. Calamine base price per 2,000 lb., ore assaying 40% zinc, $55@45; average realized for week's sales, $47.50 per ton.

Lead, base price per 2,000 lb. ore assaying 80% lead, $72.50 @70; average realized for week's sales, $69.51; high price, $72.10 per ton.

Shipments for week ended July 22 were 4,751 tons blende, 227 tons calamine and 764 tons lead ore. For year to date, 195,978 tons blende, 15,288 tons calamine and 33,641 tons lead ore. Total value, $388,890 for the week; $23,788,850 for the year to date.

A low stage of water in the streams from which electricity is generated by water power for the mines has created a shortage of power, and lack of power is preventing a number of mines operating steadily, and the production of ores is lessened by this cause, and further by some mines closing down on account of the 90% advance in dynamite and other high costs that deplete the profit side of the mining business. From a production of 10,000 tons per week in April it has dropped to under 7,000 tons. Further reduction is indicated.

Butte, Mont., July 20—The Butte & Superior Co. reports that in June 48,475 tons of ore were treated, with a recovery of 10,830 tons of zinc concentrates; a decrease of 828 tons from May.

OTHER ORES

Antimony Ore—Small business was reported for local stocks, prices ranging from $1.25@1.50 per unit.

Tungsten Ore—Buyers and sellers were still unable to get together. The market is quoted nominally at $27@30 per unit, for which most of the largest producers are holding. European inquiries are reported in the market. The recession in tungsten prices is believed to have brought about a considerable curtailment of production.

Charles Hardy, of 50 Church St., New York, has been appointed New York broker for the Atolia Mining Co.

Iron Trade Review

NEW YORK—July 26

The feature of the week is the Steel Corporation statement for the June quarter, which is fully up to expectations and shows net earnings unparalleled in the past.

There is no considerable change in the actual condition of the iron and steel market. Domestic orders continue to be rather limited, but export business is pressing and large contracts have been placed or are under negotiation. No price changes are reported. The discussion over steel-bar contracts is not yet closed, the agricultural implement makers holding back for some further reduction in price. Structural steel is slow, owing to questions of price and delivery which have brought about some delay in building projects. The most pressing business just now is in plates, for which the demand is strong. Railroad and car material buying is chiefly for export.

In the pig-iron market the principal feature is the demand for bessemer and low-phosphorus pig for export. Hot weather is affecting the output of the blast furnaces about as usual at this season.

PITTSBURGH—July 25

Steel-mill outputs continued to be curtailed by the hot weather and on the whole the output this month will represent a larger curtailment than usual for July, though the actual output will be much larger than in any previous July.

The domestic market continues extremely quiet, new buying being very light. The continued dullness emphasizes the inherent strength of the situation, as the steel mills have shown no signs of wavering in the matter of prices. There is a disposition to deny recently published reports that steel bars were sold to agricultural-implement makers for the first half of 1917 at 2.35c., although for the implement makers to pay as high as 2.35c. would represent a strong market, when early in the year they paid 1.90c. for second-half deliveries only under protest. It is evident that the mills purpose maintaining 2.50c. on bars in the general market.

IRON ORE

Exports and imports of iron ore in the United States five months ended May 31 were in long tons:

	1915	1916	Changes
Imports	432,996	501,873	I. 68,877
Exports	22,900	151,593	I. 128,693
Excess, imports	410,096	350,280	I. 59,816

Exports are chiefly of Lake Superior ore to Canadian furnaces.

A record cargo of iron ore passed through the Sault Ste. Marie Canal last week. It was 15,008 tons of ore carried by the "W. P. Snyder, Jr." on 20 ft. 6 in. draft. It was bound from Duluth to Cleveland.

Announcement is made by the Lake Carriers' Association that the recommended loading depth for boats from Lake Superior to Lakes Michigan and Erie be increased from 19 ft. 11 in. to 20 ft. 10 in. The greater depth means, on the average, 800 tons of iron ore more per cargo. The increase in depth is due to dredging recently completed in Lake St. Clair. From now till the season's close this increase in tonnage will amount to about 5,000,000 tons.

COKE

Coke production in the Connellsville region for the past week is reported by the "Courier" at 418,016 net tons; shipments, 417,027 tons. Shipments of Greensburg and Upper Connellsville districts, 36,012 tons. Hot oppressive weather continues to keep down the production.

From Birmingham, Ala., it is reported that the orders for coke there are pressing, especially for foundry coke. The plants making coke for sale are overrun and prices for foundry coke are quoted as high as $4.25 per ton at ovens.

Assessments

Company	Delinq.	Sale	Amt.
Algomah, Mich.	May 18	.....	$1.00
Blue Bell, Ida.	July 8	Aug. 5	0.002
Cedar Creek, Ida.	July 5	Aug. 5	0.01
Clear Grit, Ida.	Aug. 7	Aug. 25	0.002
Columbus Ext., Utah	July 13	Aug. 8	0.02
Cons. Imperial, Nev.	July 18	Aug. 10	0.01
Cons. Virginia, Nev.	July 27	Aug. 17	0.05
Crackerjack, Nev.	July 3	Aug. 1	0.01
Emerald, Utah.	July 15	Aug. 11	0.00½
Four Timbers, Ida.	July 26	Aug. 26	0.002
Friend, Ida.	June 30	July 20	0.002
Gold Mt. Champion, Utah.	July 20	Aug. 10	0.0025
Gould & Curry, Nev.	July 14	Aug. 3	0.03
Great Western, Nev.	July 24	Aug. 15	0.005
Hope, Calif.	July 17	Aug. 14	0.01
Hugo, Ida.	July 29	Aug. 30	0.002
Independence, Ida.	July 8	July 29	0.001
Iron Spar, Ida.	July 17	Aug. 15	0.003
Jacket-C. Point-Belcher, Nev.	Aug. 14	Sept. 7	0.05
Jack Waite, Ida.	July 27	Aug. 28	0.01
Kewanas Reor., Nev.	Aug. 2	Sept. 6	0.01
Lehi Tintic, Utah.	Aug. 5	Aug. 25	0.0025
Lucky Calumet, Ida.	July 20	Aug. 21	0.005
Morgan Argentine, Utah.	July 15	Aug. 5	0.01
Nevada-Douglas, Nev.	July 15	Aug. 16	0.10
Nevada Zinc, Nev.	Aug. 14	Sept. 2	0.01
North Lake, Mich.	June 14	.....	1.00
Old Veteran, Ida.	July 8	Aug. 5	0.002
Sierra Nevada, Nev.	July 11	Aug. 3	0.10
Silver Moon, Ida.	July 8	Aug. 3	0.005
Silver Pick, Nev.	July 5	Aug. 14	0.01
Southern Swansea, Utah.	July 17	Aug. 5	0.001
Spearhead Reor., Nev.	July 3	Aug. 3	0.01
Sunrise ,Ida.	July 27	Aug. 28	0.002
Swansea Ext., Utah.	July 10	Aug. 1	0.0025
Tar Baby, Utah.	Aug. 3	Sept. 4	0.01
Tarbox, Mont.	July 25	Aug. 12	0.005
Tiberius, Ida.	July 8	Aug. 1	0.001
Tintic Central, Utah.	July 12	Aug. 8	0.005
Ton. Gypsy Queen, Nev.	July 11	Aug. 15	0.01
Uvada, Nev.	June 24	July 27	0.02
Victoria, Utah.	July 8	Aug. 2	0.005
Wolf Mt. Copper, Utah.	Aug. 2	Sept. 6	0.005

Stock Quotations

SAN FRANCISCO July 25	
Name of Comp.	Bid.
Alta.	.04
Andes.	.10
Best & Belcher.	.05
Bullion.	.01
Caledonia.	‡.44
Challenge Con.	.03
Confidence.	.18
Cons. Imperial.	.01
Con. Virginia.	.12
Gould & Curry.	.03
Hale & Norcross.	.05
Jacket-Cr. Pt.	.03
Mexican.	.16
Occidental.	.70
Ophir.	.21
Overman.	‡.05
Savage.	.04
Seg Belcher.	.02
Sierra Nevada.	.31
Union Con.	.66
Utah Con.	.01
Belmont.	4.05
Jim Butler.	.86
MacNamara.	.04
Midway.	‡.19
Mont.-Tonopah.	.25
North Star.	.14
Rescue Eula.	.23
West End Con.	.81
Atlanta.	.10
Blue Bell.	.01
Booth.	.13
C.O.D. Con.	.03
Comb. Frac.	.06
D'field B.B.	.02
D'field Daisy.	.02
Jumbo Extension.	.78
Pitts.-Silver Peak.	.12
Round Mountain.	.46
Sandstorm Kendall.	.04
Silver Pick.	.11
Central Eureka.	.10
Argo.	.08
Ariz. Central.	.13
Big Jim.	.90
Lazy Boy.	.12
Oatman No. Star.	.15
Tom Reed.	1.63
United Eastern.	3.62½
United Western.	.09

LONDON	July 10
Alaska Tre'dwell	£5 17s 6d
Burma Corp.	3 6 3
Cam & Motor.	0 14 3
Camp Bird.	0 9 6
El Oro.	0 9 6
Esperanza.	0 11 0
Mexico Mines.	4 0 0
Nechi, pfd.	0 16 0
Oroville.	0 18 6
Santa Gert'dis.	0 14 0
Tomboy.	1 3 6

SALT LAKE	July 24
Name of Comp.	Bid.
Alta Con.	.24
Black Jack.	.05
Colorado Mining.	.15½
Crown Point.	.03½
Daly-Judge.	7.75
Emma Cop.	.47
Gold Chain.	.22
Grand Central.	.68
Iron Blossom.	1.47½
Lower Mammoth.	.03
May Day.	.11
Opohongo.	.01½
Prince Con.	1.35
Seven Troughs.	.03
Silver King Coal'n.	3.00
Silver King Con.	3.25
Sioux Con.	.08½
Uncle Sam.	.06
Yankee.	.17½

COLO. SPRINGS	July 25
Acacia.	.03½
Doctor Jack Pot.	.09
Elkton Con.	.14½
El Paso.	.72
Findlay.	.03½
Gold Sovereign.	.03½
Golden Cycle.	2.05
Granite.	.67½
Isabella.	.17½
Jack Pot.	.05
Jerry Johnson.	.04
Mary McKinney.	.32
Portland.	1.62½
Vindicator.	2.00

TORONTO	July 24
Adanac.	1.62½
Bailey.	.06
Chambers Ferland.	.19
Coniagas.	4.25
La Rose.	.56
Peterson Lake.	.22
Right of Way.	.03
Seneca Superior.	.48
T. & Hudson Bay.	55.00
Temiskaming.	.53
Trethewey.	‡.21
Wettlaufer-Lor.	.10
Dome Exten.	.34
Dome Lake.	.32
Foley O'Brien.	.48
Hollinger.	28.00
Jupiter.	.28
McIntyre.	1.43½
Newray.	.40
Porcu. Crown.	.68½
Preston E. D.	‡.03
Vipond.	.40
West Dome.	.35½

N. Y. EXCH.	July 25
Name of Comp.	Clg.
Alaska Gold M.	18½
Alaska Juneau	8½
Am.Sm.&Ref.,com.	93½
Am. Sm. & Ref., pf.	110½
Am. Sm. Sec., pf. A	93
Am. Sm. Sec., pf. B.	84½
Am. Zinc.	33½
Am. Zinc, pf.	65½
Anaconda.	79
Batopilas Min.	1½
Bethlehem Steel.	435
Bethlehem Steel, pf.	125
Butte & Superior.	67½
Chile Cop.	20½
Chino.	47½
Colo. Fuel & Iron.	44½
Crucible Steel.	68½
Dome Mines.	25½
Federal M. & S.	12½
Federal M. & S., pf.	37½
Great Nor., ore ctf.	35½
Greene Cananea.	45
Homestake.	130
Inspiration Con.	48
International Nickel	44½
Kennecott.	45½
Lackawanna Steel.	69½
Miami Copper.	34½
Nat'l Lead, com.	63
National Lead, pf.	113
Nev. Consol.	16½
Ontario Min.	6
Quicksilver.	2½
Quicksilver, pf.	4½
Ray Con.	22½
Republic I&S, com.	46½
Republic I&S, pf.	108½
Sloss-Sheffield.	44
Sloss-Sheffield, pf.	94
Tennessee Copper.	23½
Utah Copper.	76
U. S. Steel, com.	86
U. S. Steel, pf.	118
Va. Iron C. & C.	43½

N. Y. CURB	July 25
Beaver Con.	.36
Buffalo Mines.	.87½
Butte & N. Y.	1½
Butte C. & Z.	4½
Caledonia.	.71
Can. Cop. Corpn.	1½
Cashboy.	.05
Cerro de Pasco.	34½
Con. Ariz. Sm.	1½
Con. Coppermines.	2½
Con. Nev.-Utah.	1/16
Crystal Cop.	1
First Nat. Cop.	4
Florence.	.42
Goldfield Con.	.86
Goldfield Merger.	.08½
Granite.	.28
Hecla Min.	6 1/16
Howe Sound.	4½
Jerome Verde.	1½
Joplin Ore & Spel.	2½
Kerr Lake.	4½
Magma.	13
Majestic.	½
McKinley-Dar-Sa.	.56
Mother Lode.	.31½
Nevada Hills.	.16
N. Y. & Hond.	15½
Nipissing Mines.	6½
Oro.	.04
Ray Hercules.	3½
Rochester Mines.	.58
St. Joseph Lead.	15
Standard S. L.	1½
Stewart.	.25
Success.	.59
Tonopah.	5½
Tonopah Ex.	5½
Tribullion.	½
United Zinc.	6
White Knob, pf.	1½
Yukon Gold.	2

BOSTON EXCH	July 25
Name of Comp.	Bid
Adventure.	2½
Ahmeek.	93
Algomah.	1½
Alloues.	59
Aris. Com., ctfs.	8½
Bonanza.	.25
Butte-Ballaklava.	1½
Calumet & Ariz.	68½
Calumet & Hecla.	515
Centennial.	14
Copper Range.	57½
Daly West.	2½
East Butte.	11½
Franklin.	6½
Granby.	81
Hancock.	11
Helvetia.	.20
Indiana.	2
Island Cr'k, com.	44
Island Cr'k, pfd.	88½
Isle Royale.	25
Keweenaw.	3½
Lake.	11
La Salle.	‡1
Mason Valley.	1½
Mass.	11½
Mayflower.	2
Michigan.	2½
Mohawk.	81
New Arcadian.	5
New Idria.	11
North Butte.	20
North Lake.	1½
Ojibway.	1
Old Colony.	1½
Old Dominion.	62
Osceola.	81
Quincy.	82
St. Mary's M. L.	71½
Santa Fe.	1½
Shannon.	7½
Shattuck-Ariz.	26
So. Lake.	4½
So. Utah.	.19
Superior.	12½
Superior & Bost.	4
Tamarack.	37
Trinity.	4½
Tuolumne.	.35
U. S. Smelting.	67½
U. S. Smelt'g, pf.	50
Utah Apex.	3½
Utah Con.	12½
Utah Metal.	6½
Victoria.	3
Winona.	4½
Wolverine.	48
Wyandot.	1½

BOSTON CURB	July 25
Bingham Mines.	9½
Boston Ely.	1
Boston & Mont.	.91
Butte & Lon'n Dev.	.67
Calaveras.	4½
Calumet-Corbin.	.02½
Chief Con.	1½
Cortez.	.35
Crown Reserve.	.45
Davis-Daly	1½
Eagle & Blue Bell.	1½
Houghton Copper.	1½
Iron Cap Cop., pf.	5
Mexican Metals.	.31
Mines of America.	2½
Mojave Tungsten.	4
Nat. Zinc & Lead.	1 1/16
Nevada-Douglas.	1
New Baltic.	1½
New Cornelia.	12½
Ohio Copper.	.10
Oneco.	.80
Raven Copper.	.06
Rex Cons.	.25
Rilia.	.21
United Verde Ext.	27½

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1914	1915	1916	1914	1915	1916
January.	56.572	48.855	56.775	26.553	22.731	26.960
February.	57.506	48.477	56.755	26.573	22.753	26.975
March.	58.067	50.241	57.935	26.788	23.708	27.597
April.	58.519	50.250	64.415	26.958	23.709	30.662
May.	58.175	49.915	74.269	26.704	23.570	35.477
June.	56.471	49.034	65.024	25.948	23.267	31.060
July.	54.678	47.519	.....	25.219	22.597	.....
August.	54.344	47.163	.....	25.979	22.780	.....
September.	53.290	48.680	.....	24.260	23.591	.....
October.	50.654	49.385	.....	23.199	23.925	.....
November.	49.082	51.714	.....	22.703	25.094	.....
December.	49.375	54.971	.....	22.900	26.373	.....
Year.	54.811	49.684	.....	25.314	23.675	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan.	13.641	24.008	60.756	88.083	65.719	116.167
Feb.	14.394	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April.	16.811	27.895	75.096	124.319	*	137.389
May.	18.506	28.625	77.600	135.457	*	152.522
June.	19.477	26.601	82.574	112.432	95.333	137.455
July.	18.796	.....	76.011	.....	91.409	.....
Aug.	16.941	.....	68.673	.....	82.333	.....
Sept.	17.502	.....	68.915	.....	85.250	.....
Oct.	17.686	.....	72.601	.....	88.000	.....
Nov.	18.627	.....	77.744	.....	93.273	.....
Dec.	20.133	.....	80.773	.....	100.43	.....
Year.	17.275	.....	72.532	.....	.....	.....

TIN

Month	New York		London	
	1915	1916	1915	1916
January.	34.260	41.825	156.550	175.548
February.	37.415	42.717	176.925	181.107
March.	48.426	50.741	180.141	193.609
April.	47.884	51.230	166.225	199.736
May.	38.790	49.125	162.675	196.511
June.	40.288	42.231	167.636	179.466
July.	37.423	.....	167.080	.....
August.	34.389	.....	151.440	.....
September.	33.125	.....	152.625	.....
October.	33.080	.....	151.554	.....
November.	39.224	.....	167.670	.....
December.	38.779	.....	167.000	.....
Av. year.	38.590	.....	163.960	.....

LEAD

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January.	3.729	5.921	3.548	5.826	18.606	31.167
February.	3.827	6.246	3.718	6.164	19.122	31.988
March.	4.053	7.136	3.997	7.375	21.883	34.440
April.	4.221	7.630	4.142	7.655	21.094	34.368
May.	4.274	7.463	4.182	7.332	20.347	32.967
June.	5.932	6.936	5.836	6.749	25.170	31.011
July.	5.659	.....	5.531	.....	24.611	.....
August.	4.656	.....	4.520	.....	21.946	.....
September.	4.610	.....	4.490	.....	23.151	.....
October.	4.600	.....	4.499	.....	23.994	.....
November.	5.155	.....	5.078	.....	26.278	.....
December.	5.355	.....	5.266	.....	28.807	.....
Year.	4.673	.....	4.567	.....	22.917	.....

SPELTER

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb.	8.436	18.420	8.255	18.260	39.819	97.762
Mar.	8.541	16.846	8.360	16.676	44.141	95.048
April.	10.012	16.695	9.837	16.525	49.888	99.056
May.	14.781	14.276	14.610	14.106	68.100	94.217
June.	21.208	11.752	21.038	11 582	100.614	68.591
July.	19.026	.....	18.856	.....	97.250	.....
Aug.	12.781	.....	12.611	.....	67.786	.....
Sept.	13.440	.....	13.270	.....	67.841	.....
Oct.	12.800	.....	12.596	.....	66.536	.....
Nov.	15.962	.....	15.792	.....	88.409	.....
Dec.	15.391	.....	15.221	.....	89.400	.....
Year.	13.230	.....	13.054	.....	67.553	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported.

PIG IRON IN PITTSBURGH

Month	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January.	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February.	14.55	21.16	13.45	18.93	13.90	19.51
March.	14.55	21.81	13.45	19.20	13.95	19.45
April.	14.55	21.65	13.45	18.95	13.95	19.45
May.	14.61	21.78	13.60	19.11	13.83	19.58
June.	14.70	21.95	13.67	18.95	13.77	19.34
July.	14.94	.....	13.91	.....	13.58	.....
August.	16.01	.....	15.31	.....	14.75	.....
September.	16.86	.....	15.95	.....	15.70	.....
October.	16.95	.....	15.96	.....	15.80	.....
November.	17 57	.....	16.47	.....	17.20	.....
December.	19.97	.....	18.44	.....	18.95	.....
Year.	$15.82	.....	$14.76	.....	$14.95	.....

‡As reported by W. P. Snyder & Co.